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Editorial Notes

Research in the Industry

THE war made it impossible to hold the Autumn Research Meeting of The Institution of Gas Engineers, which was to have taken place in London on Tuesday and Wednesday of last week. This, it should be understood, is purely a war-time measure; there is no intention of departing from a custom which has proved of the greatest value to the Industry. In the circumstances, however, the next best plan has been adopted. The Institution has published—the 45th and 46th Reports of the Joint Research Committee excepted—the Research Communications as the familiar blue books; and these, extracts of which we shall publish in the "JOURNAL," are open to written discussion. The pages of the "JOURNAL" will thus preserve a continuity of interest in the prosecution of research, which must go on as far as possible unabated, in spite of war.

The war has come at a time when the Industry, after many years of patient effort, had evolved a more comprehensive organization for research—a co-ordinated scheme embracing all the interests concerned, rightly bringing within its ambit representation and active support of the manufacturers of gas-making plant and gas-consuming appliances. It was a plan of the utmost promise based on effective co-ordination; and it is to be hoped that the war, while it will doubtless render necessary modifications of the programme, will aid rather than retard the fusion of interests, by which method alone, as we have for long emphasized, can research yield the most fruitful results. It is to be hoped, too, that the inability to present and discuss the Reports and Papers at a Research Meeting will not lead to any less attention being given to their contents.

In his general introduction to the 5th Report of the Research Executive Committee, a lengthy extract of which will be found in to-day's "JOURNAL," Mr. E. V. Evans, as Chairman, outlined the steps taken in the formation of the Gas Research Board—an "autonomous body representing both the supply side and the plant and appliance manufacturing side of the Gas Industry"; a body to permit all interested parties concerned with the technical work of the Industry to have a share in a co-operative effort. An essential feature of the scheme was the appointment of a whole-time Director of Research who would keep closely in touch with investigations being carried out and who would also act to facilitate the exchange of technical information. The war interfered with this appointment, but very rightly it was decided that the Board should commence to function in close association with the Emergency Panel of the Council of the Institution. Research work hitherto directed by the Research Executive Committee will in future be controlled by the Gas Research Board. The Secretary of the Institution, Dr. Braunholtz, has been given the responsibility of Acting Director of Research for the period of the war. It is a source of satisfaction that machinery was evolved in peace-time which bids fair to benefit the Industry and the nation in time of war, for there are bound to be war-time technical problems which will require solution.

High-Pressure Gasification

As we have already mentioned, the 45th and 46th Reports of the Joint Research Committee are not being published for the time being. The two Reports have been prepared for publication, but it has been decided that to publish them at the present time would not be in the public interest. They will, however, be released at the earliest appropriate moment. We are told, though, that the two documents record distinct advances in our knowledge of the gasification of coal. One of them contains a survey of the possibilities of high-pressure gasification based upon the knowledge derived from experimental work carried out at Leeds University; the other is concerned with a study of the mechanism of the reactions between carbon and carbon dioxide and water vapour—a study which has resulted in a clearer picture of the mechanism of the reactions.

It is, of course, highly unfortunate that the findings of the continued investigation on high-pressure gasification could not be published, for the greatest interest had been aroused in the results of this work undertaken on a small-scale laboratory unit. Referring to these results as set out in the Report presented a year ago we said they pointed to the desirability of accelerating the work by strengthening the personnel engaged on it and spending more money on it. The possibilities are fascinating. There is no doubt about that. The rate of hydrocarbon production in the laboratory apparatus was alone of extraordinary interest. It may be recalled that heat-

ing coal at 12° C. per minute and supplying hydrogen equivalent to 58,000 cu.ft. per hour gave the first 200 therms of hydrocarbons per ton at an average rate of 220 therms per hour, corresponding on dilution to gas of 500 B.Th.U. per cu.ft. with a rate of gas production of 415 therms per hour per ton. The output obtained by normal large-scale carbonization is in the neighbourhood of 7 therms per hour per ton.

There is, of course, apt to be a whole world of difference between results on a small laboratory scale and those obtained when larger scale working is attempted. Difficulties are bound to crop up; it is in the solution of these difficulties that further work must proceed. At the moment we cannot be told the nature of any difficulties which may have beset the attempt to work the high-pressure gasification process on a rather larger scale; we must rely on those directing the research to allocate or find the money needed for the solution of these difficulties. But Mr. Evans referred to the conclusion of a working arrangement for the provision of funds jointly by the Department of Scientific and Industrial Research and The Institution of Gas Engineers for the erection and operation at the Fuel Research Station of a semi-technical plant. The outbreak of war, he said, may lead to some delay in the prosecution of the programme, but the manufacture of the necessary apparatus is well in hand.

Published Reports

Apart from the Report of the Research Executive Committee, eight Communications were to have been presented. Work has continued on the aeration test burner, the findings being given in the 44th Report of the Joint Research Committee. With its publication laboratory experiments at Leeds on the burner have been suspended. Under war-time conditions the aeration test burner should prove of value in helping to maintain a high standard of service in spite of emergencies on the manufacturing side. The combustion characteristics of town gas and its constituents was the subject of a joint Communication recording the results of work undertaken in the laboratories of the South Metropolitan Gas Company on the value of the combustion characteristics of different types of gas. The differences in combustion characteristics of the simple gases which are constituents of town gas have been examined. From these results and from those obtained from the examination of a number of typical town gases having a calorific value of 500 B.Th.U. per cu.ft. it has been possible to deduce the probable behaviour of such gases in typical commercial appliances. A Paper on factors affecting flame velocity was to have been presented by the Livesey Professor, Dr. Townend, and Dr. Maccormac, and one on the influence of pressure upon the water gas and other equilibria by Mr. Sartori and Dr. Newitt. Other Reports were those of the Refractory Materials Joint Committee, the Gas Education Committee, the Institution Gas Research Fellowship, and on the corrosion by the products of combustion of town gas under conditions of condensation and re-evaporation, the last-named investigation being carried out by Mr. Wood and Mr. Taylor. All these Communications will be dealt with in the "JOURNAL."

Reference also should be made to the good work carried out by the various Technical Committees of the Institution and by other organizations where specific investigations are being—or were being—sponsored by the Research Executive Committee. At the National Physical Laboratory much progress has been made in the study of the stresses imposed by wind on the structure of a spirally-guided gasholder and in the work on the causes of noise in gas burners. Then some highly interesting results have accrued from an investigation—unhappily postponed due to the war—at the London School of Hygiene and Tropical Medicine into the ventilation of rooms in dwelling houses and offices. It has been shown that the supposed saving to be effected by constructing rooms without flues may be more than nullified by reducing the number of occupants that the room may hold if due regard is to be paid to health and comfort.

The work of the Research Executive Committee has now passed into the hands of the Council of the Gas Research Board, the constitution of which must mean that research in the Gas Industry will be more closely co-ordinated and co-operatively directed.

Why Hesitate?

IT is essential to the life of the community that the maximum possible amount of toluene should be available for the manufacture of high explosives. Thus the Ministry of Supply in the Control of Toluene Order made to date from November 16 and issued last week. On a later page will be found the provisions of the Order, the gist of which we received as we went to press last week. In the Order as published there is no specific mention of benzole as extracted from the gas produced in continuous vertical retorts, but we are assured that low gravity benzole obtained from gas-works using continuous vertical retorts is included in the Order, under which the Minister takes control of all toluene, toluole, and all other coal tar spirits containing more than 2% of toluole. As far as we are aware, toluene is the only constituent of the group of coal-tar products to be Government-controlled. There may be more later. Toluene is a remarkable substance. It has high place as a raw material for high explosives—in war-time a paramount place. But it is not only for destructive purposes that toluene is an important product. The dyestuffs industry, the lacquer industry, the saccharin industry, the plastics industry—all depend largely on toluene. The Gas Industry, through the high-temperature carbonization process, produces toluene in quantity, for which fact the Industry should be pleased, for it is in a singularly good position—with the coke oven industry—to help the nation, and especially at the moment.

Of course, toluene, with or without much benzole, has to be scrubbed out of the gas the Industry makes, and there are some undertakings in the country which, to put it bluntly, do not like the idea of tackling a task which technically is very simple. They argue round the problem; and for what reasons? We will attempt to answer this question. The financial aspect looms largest. The conscientious gas engineer and manager says to himself: "My duty is clear. I will recommend no process to my board of directors or my committee which does not show a substantial profit." Which attitude is at any rate understandable. What we fail to understand to-day, however, is the frame of mind in which some executives—and a minority, we are pleased to say—are approaching the question of recovering benzole and toluole. They appear to be sorry, rather than glad, that they can produce materials vital in peace-time, vital in war-time. They would have them burned in a bunsen burner—or, maybe, a batswing. For the past twelve months in particular arguments have been adduced with the aim of proving on paper that the recovery of these essential products will not pay, when the right attitude should have been—as it must be—to find out how to make it pay. We have said for a long time that to burn raw coal in the domestic grate is a wasteful process. We say in time of war that to burn toluene in a gas burner is incredibly short-sighted. No accountants, and no scaremongers in the coke market camp, will convince us otherwise. Supposing it does not "pay" to extract toluene, which we very much doubt, how much is the deficit? To what extent—for it all boils down to this—will the gas consumer suffer? A penny or twopence a therm? We wonder.

Even since the outbreak of war, meetings have been held at which discussions have taken place on the economics of benzole recovery, and our feeling is that the problem has been discussed far too much from the peace-time angle. There has been unreality in the air. Time-worn arguments have been put forward—we appreciate, sincerely enough—against the recovery of benzole. There has been a lukewarm atmosphere about these meetings—a sense of failure, a lack, certainly, of drive. And as for tying-up benzole recovery with an obvious

advantage to the whole future of the Gas Industry—that of the reduction of sulphur compounds from town gas—that would indeed be a grave step. The merits and demerits of taking this foolhardy plunge will, we presume, be considered afresh (and with dignity and seriousness) at an Institution research meeting some years after the present war is ended. When, in fact, conditions become "more normal."

The economics of benzole recovery! Think what is happening at the moment. Consider the hazards of the crews of vessels carrying coal from loading port to gas-works; the difficulties which beset undertakings operating in evacuation areas; loss of the public lighting load. Of necessity gas prices have advanced—a rise in price hardly sufficient to cover war-time expenditure in manufacture and distribution. Serious increases, though—increases of the order of 2d. a therm, or more. Yet we still find gas engineers arguing about a problematical increase of, say, 0·01d. a therm consequent upon benzole and toluene recovery, the recovery of products vital to the prosecution of war and necessary raw materials in time of peace. If they have time in these days to argue upon this theory, well and good, so long as such arguments and the conclusions drawn from them do not in the slightest degree modify the vital resolution to get on with the job.

Not long ago, the time can be measured in weeks, we received regularly reports of gas engineers' talks at gatherings of Rotarians and the like—educative talks over lunch; very useful talks. In the majority of these talks the theme was the same. To wit, the great service which the Gas Industry was rendering, and could render, to the nation. All about supplies of aspirin and sweet perfume and rich colours in time of peace; supplies of raw materials for high explosives should war grimly come upon us. War has come; and it seems to us that after the wordy aspirations of the lunch or dinner table any discussion centred on ±0·01d. a therm due to benzole and toluole recovery is utterly unworthy. After all, benzole recovery represents a substantial consumer—an uncomplaining consumer which takes a nice little load of 5%. The while many gas undertakings are registering decreases in output of anything between 10% and 25%, which, we interpret, means idle plant and frozen capital, the charges on which must fall on each therm of gas sold.

"What is wanted," we have heard frequently since September 3 last, "in regard to benzole and toluene recovery is a lead." Well, no lead is wanted now. The Minister of Supply has stated categorically—and his assertion can be seen in black and white for one penny, which is the price of the Control of Toluene Order—that it is essential that the maximum possible amount of toluene should be available for the manufacture of high explosives. And this brings up another point of some importance concerning which we have definite views. That point is the provision of capital for the erection of benzole recovery plant. If, it is argued in certain quarters, the Government wants toluene, then the Government should foot the bill for the erection of the necessary plant on gas-works. For years there has been talk *ad nauseam* of Government shackles—of how obsolete legislation has retarded gas progress. Are we now to suppose that gas undertakings are proposing to go cap in hand to the Government for a little money to erect plant for the reckless adventure of recovering benzole and toluene from gas? Our advice to gas undertakings in this regard—and we do not ask them to take it, but at least to give it consideration—is to go ahead with the installation of recovery plant irrespective of Government assistance. The Gas Industry desires liberty of action as far as is reasonable. Let it preserve its liberty in the installation of benzole recovery plant, remembering that it is essential that the maximum possible amount of toluene should be available for the manufacture of high explosives. Remembering, too, to exercise a modicum of perspective when debating, under war-time conditions, the *real* significance of ±0·01d. per therm of gas sold due to the recovery of products which are vital to the prosecution of the struggle against evil and aggression.

Nominal Quotations

WE have received a number of letters in recent weeks from Engineers, Managers, and Secretaries of gas companies on the subject of the stock and share lists which we publish weekly in the "JOURNAL," and the heavy reductions in quotations given therein. In a few cases these letters have contained almost a streak of reproach against ourselves, which is entirely unjustified, and no doubt due to misapprehension. The London quotations which we give are, of course, those of the Stock Exchange Official List and Supplementary List, for which we have no responsibility whatever. The lower price is that at which stock can be sold on the Exchange. The upper price is that at which they will sell stock, with the very important reservation "if any is on offer." It is well known that gas stocks are as a rule very tightly held, and on a recent occasion a Gas Company Secretary told us that he tested the market by giving his broker a firm order to buy at five points above the nominal quotation, and has so far failed to obtain any stock whatever. Incidentally this particular quotation has in the meantime been raised—whether or not as a result of his order we cannot, of course, say.

What we wish to emphasize in this note is that the prices are "nominal quotations," and not necessarily connected with the price at which business has been, or can be, done. On the Stock Exchange the public deal with brokers, but the brokers only buy and sell stock for the public from and to the jobbers, who might be described as the wholesalers. In times of uncertainty the latter are naturally unwilling to take unlimited stock on their books, and so they protect themselves by making prices which will either not tempt the stockholder to sell, or at which they, the jobbers, know they can resell at a profit.

To those to whom the procedure of the Stock Exchange is even better known than to us, we apologize for this elementary explanation of the broad principles upon which it works. We offer it, however, for the benefit of those who have written to us describing the quotations as "misleading," "incorrect," and so forth, and attributing some measure of blame to ourselves. They need not worry that these quotations necessarily reflect the actual market value, as anybody who tries to buy at them will in most cases quickly find out.

Price Increase Justified

IT is inevitable that a substantial rise in the price of any commodity is more often than not followed by loud-voiced protests. And for some reason or other the protests are usually all the more vehement when the commodity concerned is one supplied by a public utility undertaking. For this reason it is, perhaps, noteworthy that the recent increase in the price of gas in the Metropolis has met with rather less than the volume of criticism which might have been expected. This is doubtless due in no small measure to the companies' wise step in taking the public into their confidence immediately prior to the increase and making it abundantly clear why such a step was unavoidable if the financial structure of the undertakings was to be preserved during a time when they were supplying a service of more than ever vital importance. There was, nevertheless, a certain amount of criticism in various quarters; indeed, it is understood that pressure was brought to bear with a view to instigating an enquiry into the justification for the increase. It is therefore interesting to note that the President of the Board of Trade, replying to a question in the House last week, observed that he was informed of the intention to increase the price shortly before the public announcement was made, and that he was satisfied the increase was not only justified, but that it might be possible to justify an even greater increase. Such a statement as this should provide the public with sufficient assurance that they are not being exploited.

Both prior to and since the announcement by the London Companies we have reported in the columns of the "JOURNAL" a substantial number of price increases in all

parts of the country—some large, some small, but all undoubtedly warranted in the light of the exceptional circumstances which now exist. The general public can have little or no conception of the difficulties with which gas undertakings are faced at the present time. Heavy expenditure on A.R.P., covering both works and distribution systems, the rise in the cost of coal and other materials, the lighting restrictions, and the effect of evacuation—all have unfortunately left their mark upon the balance-sheet. But in every case where prices have had to be increased the public may rest assured that their supply undertaking has done no more than circumstances render absolutely essential to the maintenance of their operations.

The latest announcements include Stretford, Manchester, and Glasgow—all undertakings falling within the category of those hardest hit by the conditions to which we have referred. And in all these cases the unwelcome move has been accompanied by a frank statement to consumers as to why the step has had reluctantly to be taken. This policy of giving consumers an explanation of the necessity for the increase will do much to preserve the goodwill which the Gas Industry has been at such pains to build up during past years, the loss of which would inevitably retard future progress.

The Murdoch Centenary

Some idea of the prestige the Gas Industry might have obtained from the Murdoch Centenary if war had not enforced the cancellation of the commemoration plans is indicated by attention which has been given to the subject by the Press during the last few days. Despite the preoccupation of most newspapers with the war, a considerable amount of editorial space was given over to articles on Murdoch's life and work—and the Gas Industry comes very well out of it. The William Murdoch Memorial Committee is to be congratulated on this excellent achievement under difficult conditions.

Personal

Mr. CECIL G. LANGFORD, Managing Director of George Glover and Co., Ltd., has been elected to the Board of Richmonds Gas Stove Co., Ltd. (Radiation Ltd.).

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MR. J. N. DERBYSHIRE and MR. E. J. FOX, Directors of the Stanton Ironworks Company, have joined the Board of Stewarts and Lloyds, Ltd.

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Ald. Sir J. CLIFFORD TOZER has been re-elected Chairman, and Councillor LOUIS H. HODGE Vice-Chairman, of the Plymouth Corporation Gas Committee.

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To fill the vacancy on the Board of Directors of the Chapel, Wharley and District Gas Company, caused by the death of Mr. J. W. Broadhurst, J.P.—who had been a director since the Company was formed—Mr. J. A. WORTH, a local councillor, has been elected.

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With his election to the Chairmanship of the Marple U.D.C. Gas and Electricity Committee, Councillor J. SMITH returns to a seat which he has held for 26 of the 30 years he has served as a member of the Council.

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The Directors and Officials of the Saltcoats Gas Company, and their wives, recently attended a social function held to celebrate Mr. JOHN M. ORR'S attainment of his 25th anniversary as a Director of Company. Mr. Orr for the past 18 years has been Chairman of the Undertaking. During the proceedings Mr. James Campbell, on behalf of the Directors, handed to Mr. Orr a unit bookcase, Mrs. Orr receiving a handbag. Each lady present received a souvenir from Mrs. Orr.

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Mr. H. H. FOSTER, formerly Assistant Inspector of Gas Meters and Deputy Gas Examiner for the City of Exeter, has been appointed Superintendent Gas Examiner and Gas Meters Inspector for the City of London. The appointment dates from Oct. 7, that being the date of the retirement of Mr. G. HUME, who was held the position for nearly 30 years. On Nov. 21, Mr. Hume was the recipient of a silver wristlet watch, presented to him by the staff of the Gas Meter Testing Department as a reminder of the happy relationship which had always existed in the Department.

Obituary

The death occurred at his home, Ulley Grange, Nr. Sheffield, on Nov. 7, of Mr. HAROLD A. WRIGHT, Managing Director of the Rotherham and District Collieries Association, Ltd.

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Mr. BENJAMIN WESTALL, of Burton Joyce, Notts, has died at the age of 77. He was formerly General Manager of the Gibralta Gas Company. In earlier life he was with the Salford Corporation Gas Department.

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The death has taken place at the age of 90 of Mr. A. CLEAVER, of Caerdeon, St. Asaph (Flintshire), who for more than 50 years had been a Director of St. Asaph Gas Company.

The death has taken place in his 80th year of Mr. JOHN HOUSTON, J.P., who for 55 years was Gas Manager at Kilbirnie, Ayrshire.

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We regret to announce the death on Nov. 16, at his residence, Cliff House, Ravenscar, of Mr. J. FIRTH BLAKELEY at the advanced age of 80.

He retired about 15 years ago from an active part in the firm of Firth Blakeley, Sons & Co., Ltd., of Vulcan Ironworks, Church Fenton, of which firm he was the founder. In the 'eighties he was on the staff of Messrs. Robert Dempster & Sons, Ltd., of Elland, and at a later period with Messrs. W. C. Holmes & Co., Ltd., of Huddersfield. It was during these years that he realized the opportunities in the buying and selling of second-hand gas plant, as no other firm in the country at that time specialized in this branch of the Gas Industry.

He commenced in a small way by leasing some premises at Thornhill, nr. Dewsbury, and his expectations proved very successful as the business grew rapidly, and, with the help of his sons who later joined him in the business, it outgrew these premises at Thornhill. It was necessary to find a new site, and in deciding on the suitability of a new position, Mr. Blakeley realized the necessity of obtaining one with adequate railway facilities. Church Fenton was the place decided upon, as it was a railway junction, lending itself very well in respect to transport services. Some 16 acres of land were purchased, upon which was built modern workshops which have been considerably extended from time to time. Soon after the inception of the business it was decided to enter the field of new gas plant, and this grew so rapidly that it was decided to drop the second-hand side of the business and concentrate entirely on new gas plant, coke oven, chemical and kindred plant. To-day their products are known throughout the British Isles, the Dominions, Colonies and abroad.

The business of the firm will continue to be carried on by his three sons. Many friends of the late Mr. Blakeley have predeceased him, but some are still left who will remember his genial personality, and who will sympathize with the family in their bereavement.

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The death has occurred, at the age of 83, of Sir ROBERT S. GARDINER, who was prominently associated with the Gas Industry for 40 years. His connexion with the Industry began with his appointment as Secretary of the Imperial Continental Gas Association in 1879, and in later years he was closely concerned with the Industry in France. He resigned his Secretaryship of the Imperial Continental Gas Association in 1894 to accept the position of General Manager of the Owners of Pelton Collieries, Ltd. Subsequently he was appointed to the Boards of the Danish Gas Company, the British Gas Light Company, and Deputy Chairman of the European Gas Company. He retired from the Gas Industry in 1920 on medical advice. Sir Robert received his Knighthood in 1922, which was peculiarly appropriate as it fell on the eve of the visit of French gas engineers to London, to many of whom he was personally known. He was an Officer of the Legion of Honour, a Knight of the Order of Leopold, and a Knight of the Order of St. John. He always took an active interest in philanthropic work and was a strong advocate of granting pensions to aged workmen, the gas companies and collieries with which he was associated being among the first to introduce permanent schemes on a non-contributory basis.

Letters to the Editor

Economics of Benzole Recovery

Sir,—I have been interested in the discussion on Benzole Economics between Mr. Rae and Mr. Baird, and with your permission I would like to make a few comments. Mr. Baird's foremost objection to benzole recovery is the extra coke produced, and it would appear that he has such an antipathy to coke production that he ignores this very important revenue producing asset from his balance sheet.

In the "GAS JOURNAL" of Nov. 15, p. 345, under "additional income" he calculates the coke produced from the extra 1,116 tons of coal carbonized on a basis of 8.5 cwt. per ton of coal carbonized. The actual yield of coke per ton of coal carbonized, after meeting the requirements of the setting producers, is given as 9.2 cwt., so that the figure of 8.5 cwt. would appear to be the residual coke for sale after meeting the fuel demands of the boilers to provide steam for retort steaming, power, gas dehydration, together with the needs of the benzole plant.

Having provided for the whole steam requirements of the works at the expense of the benzole plant he proceeds again to charge the benzole plant with an allocation of boiler fuel under "additional expenditure."

It is apparent, therefore, that the figure used for "extra coke produced" is incorrect, so let us determine what the extra coke production under benzole recovery really was.

Mr. Rae says there was an increase of 0.3 cwt. of coke per ton of coal carbonized—that is on *all* the coal carbonized and not just confined to the *additional* coal carbonized.

This would be equal to 8,734 × 0.3 = 2,620 cwt., or 131 tons of extra coke based on the original coal carbonized. To be added to this figure is the coke yield from the extra coal carbonized—that is, 1,116 × 9.2 = 10,267 cwt., or 513 tons 7 cwt. The total extra coke produced is, therefore, 644 tons 17 cwt.

The correction of this one item adds a sum of £644−£474=£170 to the "additional income."

Then there is the need to substitute the figure 10.96d. per gallon of crude for the 8¾d. figure, which, it is apparent from the statement, is a net figure arrived at after the deduction of working expenses, another case of double debits for the same item.

The effect of this correction is to add another £209 to the "additional income" side of the account, with the result that instead of showing a loss of £42 in four months, a profit of £379−£42=£337, or £1,011 over the twelve months is the result.

To prove my coke figures are of the proper order let us examine the relation between the "coal carbonized" and "coke produced" figures.

The extra coal carbonized for a recovery of 2.37 gall. benzole per ton is $\frac{1,116 \times 100}{8,734} = 12.7\%$ of the original coal carbonized.

The extra coke produced is 644 tons, which is $\frac{644 \times 100}{\frac{8,734}{20} \times 8.9} = 16.5\%$ increase on the coke yield prior to benzole recovery.

These figures are of the same order as those given before the meeting of the Midland Association of Gas Engineers, the proceedings of which appear in the "GAS JOURNAL" of Nov. 22. Here I would like to point out that any increase in sales of therms irrespective of benzole must result in an increase of coal carbonized and, correspondingly, an increased production of coke, but the reason for the relative greater increase of "coke produced" when benzole therms are the "sale" is that less water gas is being produced in the retorts; the coke saved is thus available for sale.

To turn back to Mr. Baird's contribution and his further remarks on benzole recovery from the national point of view.

The wisdom and foresight of the 8d. per gallon subsidy on benzole should now be apparent to all, by the existence of the large number of plants capable of providing the raw material for both munitions and transport which otherwise would not have come into being. With regard to the prevention of 3,000 tons of coal being exported, Mr. Rae effectively dealt with that. In a further communication in the "GAS JOURNAL" of Nov. 22, Mr. Baird brings up a number of points against benzole recovery.

He claims additional purification costs should be charged against benzole recovery.

I suggest that these will be less than when the extra "sale" is gaseous therms.

The benzole therms are less than 1% by volume of the gas being purified, and, therefore, time contact and back pressure are not affected.

The H_2S present in foul gas fluctuates considerably, influenced by carbonizing conditions, and cannot be calculated by a knowledge of the sulphur in the coal and simple arithmetic.

In the absence of benzole recovery the gas will contain a fair proportion of water gas (carburetted with benzole) and this is not H_2S free, and it is my opinion that the difference between the H_2S in the foul gas, when or when not recovering benzole, is no greater than the normal fluctuations which occur during a carbonizing period. I disagree that any fall in the price of tar should be debited solely to the benzole plant, unless it is the custom for all new therm sales to be burdened. Income-tax at 7s. 6d. in the £ is only paid on profits whether on benzole recovery or gas sales, but, as he showed a loss on the working of the benzole plant, the question of income-tax does not arise.

Local rates are also payable on gas mains. Finally, at Perth, by benzole recovery, they are drawing the revenue from the equivalent of a gas sale of 23,340,000 cu.ft. per annum at a gross price of 2s. 8.9d. per 1,000 cu.ft.

The gas production costs are 5.81d. per 1,000 cu.ft., leaving 2s. 3.09d. to meet working expenses and profit.

In short, a desirable and profitable source of *new* revenue which it would be foolish to reject.

Yours, &c.,

Leeds Corporation Gas Department. F. FIRTH,
Nov. 26, 1939. Chief Chemist.

Meter Diaphragms and Unaccounted-for Gas

SIR,—We have read with great interest the report of the General Meeting at Cardiff of the Wales & Monmouthshire Association of Gas Engineers and Managers on the subject of unaccounted-for gas, wherein several references were made to the potential effect of leather diaphragms of gas meters.

The difficulties which arose with leather diaphragms for gas meters during the last war were the result chiefly of the unsuitability of the tannage and the oil dressings then used, with the result that when changes were made in the composition of town gas supplied to consumers during that period the leathers were unable to resist the destructive influence of some of the components of the gases.

Towards the latter end of the war, E.I. tanned sheepskins practically ceased to be available, and gas meter manufacturers were forced to use, as an alternative, vegetable tanned skins of Scotch and Welsh lambs. While these skins were excellent in their way, as they were derived from wool sheep, they possessed structural weaknesses which were accentuated by the unsuitability of the tannage to which they had been subjected, and failed badly in consequence.

Prior to the research work carried out in 1916 by Mr. M. C. Lamb, F.C.S., F.R.M.S. (ex principal of the Leathersellers' Technical College, London), at the request of the South Metropolitan Gas Company, all leathers used for gas meter diaphragms were tanned only with the aid of vegetable tanning materials—that is to say, with the extracts of barks, &c.—and it was some considerable time before the success of the semi-chrome tanned leather recommended by Mr. Lamb became generally recognized and the resulting South Metropolitan Gas Company specification adopted almost universally for gas meter leathers.

The position is very much more satisfactory in the present war; a vast amount of experimental work has been done in the intervening years, and the particular semi-chrome tanned leather adopted to-day has been well tested in regard to its ability to stand up to any of the products which are likely to be found in gas supplies. The oil dressings have also undergone intensive tests, and the dressings which are being used to-day as a result of these tests have greatly improved performance and resistance to components in town gas.

Profiting by experience gained in the last war, most meter manufacturers have wisely increased their stocks of semi-chrome Persian gas meter diaphragms, and considerable stocks are also held by leather dressers. Should the war last so long that supplies of ideal E.I. sheep fail, alternative types of leather, tanned by modern methods, will be available to take their place, because such leathers have been undergoing tests in our technical department for some years past and valuable information obtained on best methods of tanning, cutting, and oiling such diaphragms.

Yours, &c.,

For The Metropolitan Leather Co., Ltd.,

85, Bermondsey Street, G. JESSUP CUTBUSH,
London, S.E.1. Local Director.
Nov. 23, 1939.

C

News of the Week

A Total of 104,987 Gas Meters were tested at the London County Council's testing offices between April 1 and August 31, 1939. Of these, 10,887 were rejected. The fees received amounted to £9,012.

"Working Under Emergency Conditions" was the subject of discussion at a meeting of the London and Southern District Junior Gas Association held at Gas Industry House last Saturday afternoon. The meeting was held in camera, but it is understood that a short report will be prepared for publication.

Application is to be Made by the Prescot & District Gas Company, jointly with the Liverpool Gas Company, for a Special Order under the Gas Undertakings Act, 1920 to 1934, for the purpose of extending and defining the limits within which the two undertakings shall be empowered to supply gas.

Copies of the Following recently issued A.R.P. Series of British Standard Specifications can be obtained on application to the Secretary of The Institution of Gas Engineers, 1, Grosvenor Place, S.W.1, price 3d. each: BS/ARP 19.—Adjustable hinge; BS/ARP 21.—Method for providing even illumination of low intensity (0.2); BS/ARP 24.—Hydrated lime; and BS/ARP 25.—Mortar.

The Tests of Gas supplied to consumers in London, states the L.C.C. Public Control Committee in their report for the period April 1 to August 31, indicated that the average calorific value of the gas was in all cases in excess of the declared value. No trace of sulphuretted hydrogen was disclosed by the numerous tests made, and continuously recording instruments showed that the pressure of the gas was maintained above the prescribed standard.

The Experimental Gas Street Lighting which, as previously mentioned in these columns, has been devised by the Lighting Superintendent at Bolton, was inspected the other night by representatives from Blackpool, including the Mayor, the Chief Constable, the Transport Manager, members of the Lighting Committee, together with a number of gas and electrical engineers. The visitors were also shown the special direction indicators with which several of the lamps have been fitted.

In the Same Issue of the local newspaper in which the Deal and Walmer Gas Company announced an increase in the price of gas of 2.4d. per therm, with an accompanying explanation of the causes which have necessitated the advance, the Company inserted an advertisement with the theme "A Little Gas Goes a Long Way." Economy in the use of gas, ran the caption, need not mean discomfort, for gas is the most flexible of all fuels, answering your every need, controlled with ease, actually helping you to avoid waste. The advertisement went on to enumerate some of the things a single therm of gas will do.

The Evolution of the Gas Meter was the subject of an interesting address by Mr. J. A. Whimster, of Saltburn, to the local Rotary Club. In 1815, he said, Samuel Clegg invented the first gas meter which was a wet meter and moderately efficient except in frosty-weather. The first dry gas meter was introduced by John Meyland, of Dumfries, in 1835, but it was not an economical proposition. Thomas Glover, of Edinburgh, produced in 1842 a successful dry meter, and its principles, said Mr. Whimster, were in use to-day. The biggest gas meter was made, he remarked, in 1851 to measure the supply to the Crystal Palace.

The Next Meeting of the Fuel Luncheon Club will take place at the Connaught Rooms, Great Queen Street, Kingsway, W.C.2, on Thursday Dec. 7, at 12.40 for 1.10 p.m., when the after Luncheon Address on "Possible Fuels" will be given by Prof. A. C. G. Egerton, M.A., F.R.S., F.Inst.F. The Chair will be taken by the President, Lt.-Colonel W. A. Bristow, M.I.E.E., F.R.A.S. Members of the Institution of Gas Engineers will be welcome, and those intending to be present should forward their remittances (6s. per head, excluding gratuities and drinks) to the Secretary of the Club, Mr. R. T. Rees, 39, Bramham Gardens, S.W.5, when tickets will be sent.

With Reference to the paragraph referring to Lincoln in our issue of Nov. 22, Mr. G. Wright (City Gas Engineer and Manager) writes to point out that the question of the price of gas, in relation to the increase in the pithead price of coal, has not yet been considered by Gas Committee or the City Council. No decision, therefore, has yet been arrived at.

Increased Storage Capacity is stated by Mr. H. A. Aitken (Engineer and Manager of the Buckhaven and Leven Gas Undertaking) to be an urgent necessity if the Undertaking's continuity of supply is to be guaranteed. In his report, Mr. Aitken also recommends the acceptance of the tender of West's Gas Improvement Co., Ltd., for work in connexion with the original vertical retort installation.

A Gas Fitter joined the Army in his trade capacity, and was subjected to the usual trade test. In this case it happened to be the "blowing" of a joint, and the Inspecting Officer's report ran as follows: *Name:* Private X. Y. Z. *Test:* Joint. *Remarks:* Very well done. The following morning the I.O. received a note from the C.O.: "Instruct Private X. Y. Z. to report at the officers' mess kitchen immediately."

Opportunity for Maintaining gas goodwill is by no means lacking, despite war-time conditions and the black-out. Evidence is seen in the results of cookery demonstrations (designed with an economy "slant") recently given by the Dartmouth Gas Coal and Coke Company. Audiences were considered to be equal to pre-war, and keen interest was displayed in all that the Radiation lecturess had to say. Present conditions may well prove to offer more than usual opportunity for the Industry to earn the gratitude of the public by providing such real help in time of difficulty.

The Temporary Arrangement under which the Central Administration of the United Kingdom Gas Corporation, Ltd., undertook the management of the South-Western Gas and Water Corporation, Ltd., has been terminated by mutual agreement as from Nov. 1. A separate Central Administration Office for the South-Western Gas and Water Corporation has been established at 5, Marsh Street, Bristol, under the control of Mr. F. Allen. In future the two Corporations will operate independently, though Close Brothers, Ltd., will continue to act as Secretaries and Registrars to both.

Owing to the Increase in the war freight charges for coal and the increase of 1s. per ton authorized by the Ministry of Mines, the cost of coal to the Plymouth Corporation Gas Undertaking during the second six months of the current financial year would be advanced by approximately £12,000. This left the Committee with practically no alternative but to raise the price of gas, and it was resolved at a meeting on Nov. 23 to increase the price by 6d. per 1,000 cu.ft. as from the Christmas meter-readings, making the charge 3s. instead of 2s. 6d., which has been the price since 1935. In the case of slot meters the supply of gas will be reduced from 26 cu.ft. to 22 cu.ft. per 1d.

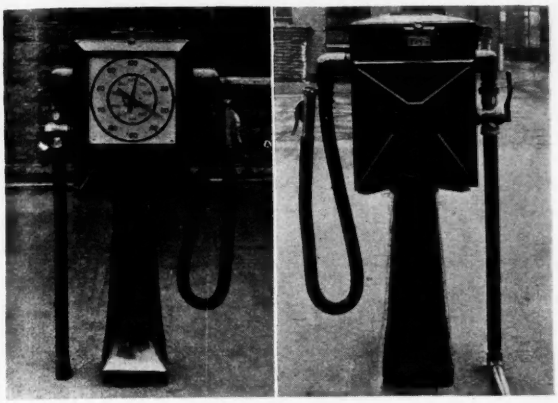
Arrangements Have Been Made at the Leicester gas-works for private and commercial motorists to be supplied with gas for their vehicles at the domestic rate, 3s. 11d. per 1,000 cu.ft., until the end of the year. Then, of course, the price will be increased, as the domestic price is increased, to 4s. 2d. Gas-driven vehicles are in use by several local firms, and gas-buses are likely to be put on the road by the City Transport Department within the next week or so.

Scunthorpe Fire Brigade were engaged from the morning of Nov. 21 until the evening of the following day dealing with a fire at the Scunthorpe gas-works which involved some 50 or 60 tons of coke in a coke hopper. A turntable ladder was found to be too short to enable the firemen to spray water on the coke, and finally they took a length of hose to a narrow platform overlooking the hopper and about 60 ft. above ground.

Meter for Gas Filling Station

A gas meter has been specially designed by the South Metropolitan Gas Company's meter shop for the measurement of gas to motor vehicle containers. This meter, which is illustrated in the accompanying photographs, was demonstrated at a recent meeting of the Industrial Gas Centres Committee.

The dimensions of the meter are as follows: Width over connexions, 22 in.; depth, 23 in.; height, 27¼in. Standard integrating dials are fitted at the back of the meter, while on the front is a 15-in. square case containing two dials—the outer marked in 10's and the inner in 100's of cubic feet, with a pointer for each dial. Therm dials can be used in place of the cubic feet dials if desired, or, alternatively, a conversion table can be attached to the meter.



In the arrangement illustrated a lever-controlled valve at the outlet end of the flexible hose ensures that the hose is always full of gas and shuts off the gas on completion of the operation of filling the container.

The London County Council testing authorities state that the meter is within limits at 2,400 cu.ft. per hour. As the meter may be used at rates greater than this in ordinary service, the South Metropolitan Gas Company have tested it at overloads, and have found it still reasonably accurate at 4,800 cu.ft. per hour. They have, however, officially rated the meter at 2,000 cu.ft. per hour, for which capacity 2-in. connexions suitable for either screwed or flanged pipes are provided.

Gas for Transport in Germany

According to a report published recently in the *Daily Telegraph*, the gravity of Germany's petrol shortage is shown by an order for the compulsory conversion to gas of all motor lorries over 30 cwt. garaged within six miles of a gas-producing plant. A start is to be made with the heaviest vehicles which use the most petrol, and owners will receive instructions telling them where to take their lorries for conversion, and imposing a time-limit.

The fact that the order is at the moment restricted to vehicles garaged within six miles of a gas-producing plant would indicate that the low-pressure gas bag method is to be employed and that the authorities realize the limitations of this system as regards range of travel. They promise, however, to establish a "close network" of gas-producing plants all over the Reich.

Forthcoming Engagements

Dec.

7.—**S.B.G.I.**—Meeting of Emergency Committee, Banbury, 2 p.m.

8.—**I.G.E.**—Joint Committee on Complete Gasification Under Pressure, Gas Industry House, 2.30 p.m.

12.—**B.G.F.**—Fifth Annual General Meeting, Gas Industry House, House, 10.30 a.m.

12.—**N.G.C.**—Central Executive Board, Gas Industry House, 11 a.m.

13.—**I.G.E.**—Liquor Effluents and Ammonia Committee, 12.15 p.m.; Joint Research Committee, 2 p.m.; at Gas Industry House. (These meetings are instead of on Dec. 15 as previously arranged.)

Gas Light and Coke Company's Revised Prices.

As announced in the "JOURNAL," the published price of gas by the Gas Light and Coke Company has been advanced by 2½d. per therm in the Company's area of supply in order to meet conditions arising out of the war. This increase does no more than cover additional costs already incurred.

In the circumstances it is impossible, the Company announces, to avoid some increase in the charges made to the block rate consumers. The Company has decided that the fairest method is to add to these charges approximately the same percentage as the increase of 2½d. per therm represents in relation to the published price—namely, 25%.

The additional charge will be effected in accordance with the accompanying schedule, and will take effect as from the date of the meter readings which are now being made.

Any charges for rentals or hire-purchase entered into under previous contracts will be unaffected by this change.

GAS SUPPLIES FOR CENTRAL HEATING.
BLOCK RATES CHARGED ON QUARTERLY CONSUMPTIONS.

		Therms.		Price per Therm. d.
For the first	100 therms, i.e. ...	1 to	100	12.25
,, ,, next	400 ,, ,, ...	101 ,,	500	9.35
,, ,, ,,	500 ,, ,, ...	501 ,,	1,000	8.75
,, ,, ,,	1,000 ,, ,, ...	1,001 ,,	2,000	7.50
,, ,, ,,	1,000 ,, ,, ...	2,001 ,,	3,000	7.15
,, ,, ,,	1,000 ,, ,, ...	3,001 ,,	4,000	6.85
,, ,, ,,	1,000 ,, ,, ...	4,001 ,,	5,000	6.55
,, ,, ,,	15,000 ,, ,, ...	5,001 ,,	20,000	6.25
,, ,, ,,	30,000 ,, ,, ...	20,001 ,,	50,000	5.90
,, all over	50,000 ,, ,, ...	... ...	... ...	5.60

Increase in Price of Coke.

The Gas Light and Coke Company announced last week that the price of coke has been increased by 3s. 4d. a ton. This increase, which dates from Nov. 20, is due to cost of production only, it is stated.

The increase in distribution costs is still under investigation by the Mines Department and will be announced later, but is not likely to amount at present to more than 1s. a ton. New and unforeseen conditions which have resulted from the war have caused serious increases both in production and distribution costs, it is stated. These have been closely investigated by the Mines Department, which has authorized the increase.

Institution of Gas Engineers.

Members of The Institution of Gas Engineers will be welcome at a meeting of the Institution of Chemical Engineers to be held in the Rooms of the Geological Society, Burlington House, Piccadilly, W.1, on December 12, at 2.15 p.m. A Paper will be presented by Prof. D. M. Newitt, entitled "Principles of Gas Compressor Design."

To afford members of the Institution of Chemical Engineers an opportunity for social reunion, an informal luncheon has been arranged for the same day at Stewart's Restaurant, Bond Street (Corner of Piccadilly), at 1 p.m. The cost will be 3s. per head (exclusive of drinks and gratuities). Members of The Institution of Gas Engineers are invited to attend this luncheon, and if they desire to do so they should notify the Joint Hon. Secretaries of the Institution of Chemical Engineers not later than December 11.

Bulk Supply to Workington Inaugurated

The supply of gas which the Workington Corporation is to take from the coke ovens of the Workington Iron and Steel Company was turned on last week by Mr. Langton Highton (General Manager of the Workington Iron and Steel Company), and Mr. Alderman Fred Hall, "father" of the Workington Town Council, in the presence of a body of Councillors and works officials.

At a lunch afterwards it was pointed out by the Mayor (Councillor Sam Walker), who is Chairman of the Workington Gas Committee, that the possibility of the coke ovens supplying gas was first mooted in 1934. A great deal of work in bringing the scheme to a successful conclusion had been undertaken by the Company and the Corporation. As they all understood, continued the Mayor, the scheme was not entirely complete, but both parties to the agreement thought it desirable that a part supply might be taken in the meantime rather than wait for the complete scheme. Arrangements were being made with the Ennerdale Rural District Council for their entire supply of gas to be met by the Corporation. It would be appreciated that this scheme, the Mayor concluded, would be the means of inducing other industries to come to the district, providing, as it would, a cheap source of heat and energy.

East Surrey Company Clarifies the Fuel and Lighting Order

The East Surrey Gas Company, in conjunction with the Reigate Electricity Department, have inserted an announcement in the district Press, which is also exhibited in showrooms and circulated to ordinary consumers with their accounts, in order to clarify the position regarding the Fuel and Lighting Order. The announcement runs as follows:

Gas and Electricity Consumption

In response to enquiries, consumers are informed, relative to the Fuel and Lighting Order, 1939, that they may consume the same amount of gas and electricity as they used last year—that is, they may consume each quarter the same quantity as they used during the corresponding quarter in the year ended at the last meter-reading before June 30, 1939.

If a consumer considers such amount insufficient for his needs—owing, for example, to prolonged absence, evacuees or household increase—or if he desires the quarterly proportions varied, he should consult the Electricity Department or the Gas Company with a view to making application to the Local Fuel Overseer for an increase or variation of his Supply.

Consumers are thus able still to enjoy the full service, advantages and economy of their gas and electricity appliances.

[Issued in the interest of consumers by the East Surrey Gas Company and the Electricity Department of the Borough of Reigate, which are at the service of consumers—old and new—in all matters concerning the economical use of fuel.]

It may be observed that this action, taken jointly by the gas and electricity undertakings, is in conformity with the move that has been made in many quarters to avoid uneconomical competition between the two supplies during the war period. Certain others of the East Surrey Company's twenty-five associated undertakings are acting similarly.

As it has been found that prepayment consumers do not generally realize that they are exempt from the rationing order, printed slips are being left at consumers' premises when the meters are emptied making the position clear.

City and Guilds of London Institute

Examinations of 1940

The Institute, after consultation with its Examinations Board, has decided to hold its 1940 series of examinations, so far as circumstances permit. This decision covers all examinations in technology. As a wartime measure, certain changes in the examination arrangements, designed to effect economy in materials and to avoid the cost of sending work to London for examination, will be introduced in some subjects.

In general, the arrangements are as follows:

All written and drawing examinations will be held on the dates given in the published calendar for 1940. Consequently, there will be no change in the arrangements for examinations which are conducted by written papers only.

In those subjects in which the examinations are conducted by written papers plus a practical test and/or specimen work and in which the entry year by year has been relatively small, there will also be no change in the published arrangements.

In the remaining subjects, in which the examinations are similar to those mentioned in the preceding paragraph, but in which the entry is larger, special arrangements for the assessment of practical tests and specimen work will be introduced. There will be no change in the published arrangements for the written and drawing papers in these subjects.

In the list of the examinations to which the special arrangements for Practical Tests will apply, is included Gas Fitting, Grade II Practical, and Final Practical.

The Institute's Examiners will set two test papers for each examination. The tests prescribed in the first paper are to be held at any time convenient to the College between April 27 and May 11 (inclusive). The tests prescribed in the second paper are to be held at any time convenient to the College between June 1 and June 15 (inclusive).

Principals of Colleges are asked, whenever possible, to accommodate external candidates for the special Practical Tests of external candidates.

The Institute intends to maintain fully the general standard of its examinations, but it nevertheless recognizes that difficult conditions under which instruction and study will be carried on in the ensuing winter and spring, and, after a review of the relevant circumstances, it considers that the situation can best be met by asking the Examiners to give a wider choice of questions.

Control of Toluene

Order Made by Ministry of Supply

As announced in last week's "JOURNAL," the Minister of Supply has made an Order under which he takes control of all toluene, toluole, and all other coal tar spirits containing more than 2% of toluene. None of these (in quantities exceeding in the aggregate one Imperial gallon in any one calendar month) may now be acquired or used without a licence from the Ministry of Supply, or sold at more than the declared maximum price, and sellers are responsible for seeing that the buyers have such a licence. The Order (S.R. and O., 1939, No. 1635; H.M. Stationery Office, 1d. net), dated Nov. 16, is in the following terms:

The "controlled material" is defined as (*a*) any toluene; (*b*) any toluole; and (*c*) any of the following materials containing more than 2% by volume of toluene—that is to say, any type or description of crude or refined benzole, xylole, coal tar, naphtha, and any other of the spirits commonly known as coal tar spirits (whether or not in fact derived from coal tar).

For nitration toluene, complying with the specification of the National Benzole Association No. 7 (1929), the maximum price is a sum made up of the last declared price per Imperial gallon paid by the Petroleum Board for motor benzole to the producers thereof at their works plus 10d. per Imperial gallon.

For toluene of less gravity than is required for the above-mentioned specification, but otherwise complying therewith, save that a slightly wider boiling range shall not be deemed to be a departure from such specification, the maximum price is a sum made up of the following: (*a*) for the toluene content the last declared price per Imperial gallon paid by the Petroleum Board for motor benzole to the producers thereof at their works plus 10d. per Imperial gallon, and (*b*) for the paraffin content the motor benzole price as aforesaid less 3d. per Imperial gallon.

In regard to 90's toluole to N.B.A. Specification (1929), the maximum price is a sum made up as follows: (*a*) where the material has a toluene content of 72%, a sum calculated at the rate per gallon made up of the last declared price per Imperial gallon paid by the Petroleum Board for motor benzole to the producers thereof at their works plus 3d. per Imperial gallon; (*b*) where the material has a toluene content greater or less than 72%, a sum calculated as in (*a*) with a bonus of $\frac{1}{16}$d. for every 1% of toluene content over 72% and a penalty of $\frac{1}{16}$d. per every 1% of toluene content below 72%.

The maximum prices set out above are for deliveries ex seller's premises in lots of not less than 10 tons each, and for settlement on or within 30 days of delivery and do not include the cost of any containers or receptacles to be retained by the buyer nor the cost of providing containers or receptacles for the transport of the material from the seller's premises to the buyer's premises. If the buyer requires delivery at any other place, or in smaller lots, or in containers or receptacles to be retained by the buyer or in containers or receptacles provided by the seller for the transport of the material from the seller's premises to the buyer's premises, or any other special service, a reasonable allowance in addition to the price may be charged for each such requirement, but each such allowance shall be separately stated in the invoice and shall not exceed the additional expense involved by reason of such requirement. If payment is not made within 30 days of delivery, reasonable interest may be charged, unless there is a provision to the contrary in the contract between the parties.

One of the first cars in London to be converted from petrol to gas, as a result of the present emergency, snapped as it was crossing Westminster Bridge

Institution of Gas Engineers

This Report was to have been presented for discussion at the Autumn Research Meeting of the Institution, which, however, had to be postponed indefinitely due to the war. Written contributions are, in the circumstances, invited.

Extract from the 5th Report of the Research Executive Committee, 1938-39

Foreword

By George Dixon, B.Eng., M.Inst.C.E., M.Inst.Gas E., President, The Institution of Gas Engineers.

It is appropriate this year, which marks the centenary of the death of William Murdoch and the birth of the Gas Research Board, to refer very briefly to the course of organized research in the Gas Industry during the past one hundred years.

Suggestions for the pursuit of centralized research investigations were made at the time of the formation, in 1863, of the British Association of Gas Managers, which later became The Institution of Gas Engineers, and were reviewed from time to time but did not materialize owing to lack of funds. It was not until 1906 that, under the stimulus of the late Dr. Charles Carpenter, the Special Purposes Fund of the Institution was started and it became possible to follow up the earlier intentions.

It will be recalled that the endowment in 1910 of the Livesey Professorship of Coal Gas and Fuel Industries at Leeds University was a pioneer step in bringing together the industrial and academic outlooks and was the starting point of an unbroken and very successful collaboration, particularly through the Joint Committee on Gas Heating, Lighting and Ventilation Research, and, since 1918, through the Joint Research Committee of the Institution and Leeds University. Since then the Institution has continuously considered ways and means of conducting and encouraging scientific investigation, not only into technical matters of immediate importance but also into problems of a more fundamental character.

The co-ordination of these investigations was organized in 1929 with the establishment of the General Research Committee of the Institution, which published its First Report in 1930, and this was superseded, in 1934, by a Scheme of Research and Technical Organization operated by the Council of the Institution through a Research Executive Committee.

Concurrently with this steady development of research by the Institution, similar developments have been taking place in the laboratories of the larger Gas Undertakings and contracting firms, and it is now felt that the time has come to join hands in the co-ordinated and co-operative development of research for the benefit of all concerned in the Gas Industry.

It was announced at the 76th Annual General Meeting of the Institution in June, 1939, that the Councils of the Institution and of the Society of British Gas Industries had recommended to the Council of the British Gas Federation that the Institution and the Society should be asked to collaborate in setting up a Gas Research Board. This has been done and a Council of the Board, comprising sixteen nominees of The Institution of Gas Engineers and nine nominees of the Society of British Gas Industries has been appointed. Sir David Milne-Watson has accepted the Presidency of the Gas Research Board.

Thus the Research Executive Committee, after five years of extremely useful service, hands on the torch to the Council of the Gas Research Board upon which its members will find themselves reinforced by prominent representatives, experienced in research, of the plant and appliance manufacturers. From henceforth research, applied to the countless problems of the Gas Industry, will be more closely co-ordinated and co-operatively directed.

Research Executive Committee

The membership of the Research Executive Committee is: E. V. Evans, O.B.E., F.I.C. (*Chairman*); Harold C. Smith, J.P., M.Inst.C.E. (*Vice-Chairman*); Stephen Lacey, B.Sc., M.Inst.C.E. (*Honorary Secretary*); J. E. Davis; H. Hollings, D.Sc.; C. A. Masterman, M.A., M.I.Mech.E., F.I.C.; T. F. E. Rhead, M.Sc., F.I.C.; E. W. Smith, C.B.E., D.Sc., F.I.C.; the President, the two Vice-Presidents, and the Honorary Secretary of the Institution (*ex officio*).

Co-opted: Harold Hartley, D.Sc.

General Introduction

It is earnestly hoped that the inability to present and discuss the Reports and Papers at a Research Meeting will not lead to any less attention being given to their contents. Written Contributions discussing and criticizing the Reports and Papers will be welcomed and will be published, with the Replies, in the usual way.

The Committee has to record with deep regret the death of Prof. Arthur Smithells, C.M.G., D.Sc., F.R.S., shortly after his resignation from the active work of the Joint Research Committee, and recalls with gratitude the pioneer work that he performed in the days when the importance to the Gas Industry of scientific research was only dimly appreciated.

General Introduction by the Chairman, E. V. Evans, O.B.E., F.I.C.

In the 4th Report of the Research Executive Committee some account was given of the views of the Committee upon the possibility of increasing the usefulness of the research organization of the Institution, and reference was made to a survey of research effort which was being planned through the co-operation of members of the Institution and members of the Society of British Gas Industries. At the 76th Annual General Meeting of the Institution the President (Mr. Robert Robertson) was able to announce the formation of the Gas Research Board, an autonomous body representing both the supply side and the plant and appliance manufacturing side of the Gas Industry. It will be recalled that the object of forming such a body was to permit all interested parties concerned with the technical work of the Industry to have a share in a co-operative effort to strengthen the scientific basis of the Industry both by the acquirement of new knowledge and by the better utilization of existing knowledge. One essential feature of the scheme is the appointment of a whole-time Director of Research who would keep closely in touch with investigations being carried out with the aid of funds supplied by the Gas Industry and who would also act to facilitate the exchange of technical information.

Subsequent to the 76th Annual General Meeting, members were appointed to the Council of the Gas Research Board by the Council of the Institution and by the Council of the Society of British Gas Industries, and a meeting of the Council of the Gas Research Board was held to set up the necessary organization. The Council of the Institution was then informed that the Gas Research Board was in a position to accept responsibility for prosecuting such research work as was already in hand under the guidance of the Research Executive Committee and such new work as might be, from time to time, submitted to the Board. Before any definite transfer of responsibility could be made, and before the Director of Research was appointed, the nation became involved in war, and having regard to all the circumstances it was considered desirable that the Gas Research Board should commence to function, but should do so in close association with the Emergency Panel of the Council of the Institution. To assist the Council of the Gas Research Board, the Council of the Institution agreed to permit the Secretary to accept the responsibility of Acting Director of Research for the period of the war. In consequence of these decisions, the research work hitherto directed by the Research Executive Committee on behalf of the Institution, will, in future, be controlled by the Gas Research Board. To this responsibility there have been added other emergency duties which the Council of The Institution of Gas Engineers has asked the Gas Research Board to undertake. These are the various technical problems which will require solution if the Gas Industry is to make its greatest possible contribution to the successful prosecution of the war.

It is considered of first importance that the Progress Reports of investigations conducted under the direction of

the Gas Research Board should be published in the Transactions of the Institution of Gas Engineers, thus preventing any break in the continuity of the records. Further, it is not proposed that there should be any departure from the present custom of holding an Autumn Research Meeting of the Institution, for it is believed that the practice of discussing the research work of the Gas Industry at such a Meeting has been of great help to the Research Executive Committee and should continue to afford guidance to the Gas Research Board.

The Technical Committees of the Institution, such as those dealing with Liquor Effluents and Ammonia, Lighting, Gas Works Safety Rules, Pipes, and Meters have hitherto been responsible to the Research Executive Committee. It is not intended that they shall come under the control of the Gas Research Board but that they shall remain as Technical Committees of the Institution co-ordinated by a Committee appointed by the Council for that purpose.

This account of the continued efforts to improve the research resources of the Industry demonstrates that the public-spirited goodwill that has been shown in discussions on the subject has led to a marked measure of success, though the full fruition of this endeavour must be postponed until more peaceable times.

The commencement of hostilities has also involved other postponements and changes to our programme that are none the more palatable for being unavoidable. The Autumn Research Meeting is not being held this year, but it would be exceedingly unfortunate if this fact were to be allowed to diminish the interest displayed in the work done during the year.

It had been hoped to present in the 45th and 46th Reports of the Joint Research Committee two documents recording distinct advances in our knowledge of the gasification of coal. The draft 45th Report contains a comprehensive and critical survey of the possibilities of high-pressure gasification based upon the knowledge derived from experimental work carried out at Leeds University. It draws attention to those features of possible processes where trouble is likely to be experienced and suggests means of avoiding these potential difficulties. The draft 46th Report is concerned with a study of the mechanism of the reactions between carbon and the gases carbon dioxide and water vapour. The physical chemistry of these reactions has been the subject of much prior work, but there has hitherto been no means of reconciling the diverse conclusions reached by different investigators. As the result of theoretical and practical studies made at Leeds University, a means of reconciliation has now been found and a much clearer picture of the mechanism of the reactions is possible. Although these two Reports have been prepared for publication the information contained in them is such that it is not considered desirable, in the public interest, that they should be published at the present time. They will, however, be released for publication at the earliest appropriate moment.

The work reported in the 44th Report of the Joint Research Committee has advanced our knowledge of the Aeration Test Burner to a point where practical experience of its usefulness as a routine test apparatus becomes of the first importance. With the publication of this Report laboratory experiments at Leeds on the Aeration Test Burner will be suspended, but the Sub-Committee of the Joint Research Committee, appointed to direct the work on Combustion Characteristics, will continue in being and will review experience gained in the use of the Aeration Test Burner together with all other information on the subject as it becomes available. It is hoped that, under war-time conditions, the existence of the Aeration Test Burner may be of special value where emergencies on the manufacturing side have to be met while still maintaining a high standard of efficiency in the service rendered to the consumer.

In the 4th Report of the Research Executive Committee presented last year reference was made to certain specific investigations which had been sponsored by the Research Executive Committee and were being carried out by other organizations. It is satisfactory to be able to report that good progress has been made at the National Physical Laboratory both in the study of the stresses imposed by wind on the structure of a spirally-guided gasholder and in the work on the causes of noise in gas burners. This second problem is proving to be of some complexity, but it has been possible already to analyse the sounds sufficiently to permit their origin to be traced, a step which should bring nearer their ultimate elimination or suppression.

The study of matters relating to the ventilation of rooms in dwelling houses and offices has produced some interesting results, and it appears that the supposed saving to be made by constructing rooms without flues may be more than nullified by reducing the number of occupants that the room may hold if due regard is to be paid to health and comfort. An interim report is now in process of preparation by the investigators at the London School of Hygiene and Tropical Medicine, but it is doubtful if further experimental work can be carried out there during the war period.

Investigations on Refractory Materials in general have continued to make progress, and details of the results obtained will be found in the 30th Report of the Refractory Materials Joint Committee. To the normal programme of work has been added a special study of the properties required in refractories for gas and coke burning appliances. A survey of existing knowledge and practice has been prepared and the deficiencies of knowledge noted with a view to making them good.

An investigation which was being carried out at the City and Guilds College, London, in co-operation with other furnace-using industries, is being continued under the guidance of Prof. C. H. Lander, C.B.E., D.Sc., with a programme modified to meet the exigencies of the times. The subject of heat transfer forms the major part of this programme which will be carried out in the laboratory, semi-commercial experiments being suspended for the time being.

The investigation at the Chemistry Department of Cambridge University of certain aspects of gaseous combustions has proceeded during the year but has, under present circumstances, been temporarily discontinued.

The possibilities of liquefied methane as a fuel for internal combustion engines have been brought to the attention of the Research Executive Committee, and support has been given to a study of the fundamental data being conducted at the Imperial College of Science and Technology, London, under the direction of Prof. A. C. G. Egerton, M.A., Sec.R.S.

During the year the Arthur Duckham Memorial Fund Committee consulted the Research Executive Committee as to a suitable subject for the Second Arthur Duckham Research Award. It was recommended, and approved by the Memorial Fund Committee, that a study be made of that class of phenomena covered by the term "luminescence," particularly as they are produced in the presence of gas flames and heated bodies. This work is being undertaken, not so much with the immediate object of developing any commercial application of the phenomena as with a hope of learning more of the changes in form as well as quantity of energy which may occur during combustion.

The co-operation with the Fuel Research Board on the subject of Complete Gasification under Pressure has advanced considerably by the conclusion of a working arrangement for the provision of funds jointly by the Department of Scientific and Industrial Research and The Institution of Gas Engineers for the erection and operation at the Fuel Research Station, East Greenwich, of a semi-technical plant for the further study of the carbonization of coal in hydrogen under pressure. Here also the outbreak of war may lead to some delay in the prosecution of the programme, but the manufacture of the necessary apparatus is well in hand.

The absence of separately published Reports of the Technical Committees dealing with Liquor Effluents and Ammonia, Lighting, Gas Works Safety Rules, Pipes, and Meters is no reflection on the amount of work done by these Committees. Accounts of their work are included in this Report and from these accounts it will be seen that their activities have covered a wide field of useful work which has been added to by the special responsibilities of the present time.

Attention is drawn to the formation during the year of the Domestic Heating Committee, the responsibility of which is to review the whole field of domestic heat requirements and to examine the position of gaseous fuel in comparison with other fuels available for similar purposes. This work necessitates not only a comparison of thermal efficiencies and relative costs, but also covers the more difficult problems of comfort and convenience to the user. Information is being collected of experience in houses where gas is the only fuel

used and already there is ample evidence that with modern gas appliances an "All Gas" house is attractive and highly appreciated by the occupants while, combined with a suitable pricing policy, it is also low in cost.

The possibilities of development in this direction represent so large an extension in the use of gaseous fuel and so substantial a contribution to the fuel economy of the nation that the subject cannot be left to develop without the fullest understanding of the many factors involved. It is necessary that we should study the effect upon comfort conditions of radiant and convected heat—both separately and in conjunction under various conditions. The work which has been done already on the importance of the type of radiation from gas fires should be followed yet further. Questions of ventilation arise and these have a significance affecting both comfort and healthy conditions of living. A particularly difficult but important aspect is the psychological one, for the frequently expressed preference for an open coal fire must have some foundation in the sensations of comfort which it produces. Whether these are due to the distribution of radiation or type of radiation or variations in temperature is not yet clear and in order that gas heating may give universal satisfaction these questions must be answered.

Technical developments of possible interest to the Gas Industry continue to be watched whether they occur in this country or abroad.

Joint Research Committee of The Institution of Gas Engineers and Leeds University

The membership of the Joint Research Committee is:

Nominees of The Institution of Gas Engineers: Harold C. Smith, J.P., M.Inst.C.E. (*Chairman*); E .V. Evans, O.B.E., F.I.C.; Stephen Lacey, B.Sc., M. Inst.C.E.

Nominees of the University of Leeds: Prof. W. T. David, M.A., Sc.D., D.Sc.; H. J. Hodsman, M.B.E., M.Sc., F.I.C.; Prof. John W. Cobb, C.B.E., B.Sc., F.I.C.; Prof. D. T. A. Townend, D.Sc., Ph.D., D.I.C. (*Honorary Secretary*).

Ex officio: The President, the two Vice-Presidents, and the Honorary Secretary of the Institution.

Co-opted: Charles F. Botley, M.Inst.C.E.; J. E. Davis; Harold Hartley, D.Sc.; F. O. Hawes; H. Hollings, D.Sc.; C. A. Masterman, M.A., M.I.Mech.E., F.I.C.; C. S. Shapley, M.I.Mech.E.

Advisory Committee on Research

The membership of the Advisory Committee on Research is:

President (Chairman), the two Vice-Presidents, Honorary Secretary, members of the Research Executive Committee, Chairmen of Technical Committees of the Institution and the Livesey Professor, all *ex officio:*

George Dixon B.Eng., M.Inst.C.E. (*Chairman*); E. V. Evans, O.B.E., F.I.C. (*Vice-Chairman*); Stephen Lacey, B.Sc., M.Inst.C.E. (*Honorary Secretary*); F. M. Birks, O.B.E., M.I.Mech.E.; Charles F. Botley, M.Inst.C.E.; J .E. Davis; H. J. Escreet, B.Sc.Eng.; H. Hollings, D.Sc.; R. W. Hunter, M. Inst.C.E.; C. A. Masterman, M.A., M.I.Mech.E., F.I.C.; T. F. E. Rhead, M.Sc., F.I.C.; E. W. Smith, C.B.E., D.Sc., F.I.C.; Harold C. Smith, M.Inst.C.E.; John Terrace, M.Inst.C.E.; Prof. D. T. A. Townend, D.Sc., Ph.D., D.I.C.; Sir Frederick J. West, Kt., C.E.B., J.P.

Representatives of Government and University Fuel Research and others having a special interest in Research:

H. T. Calvert, M.B.E., D.Sc., Ph.D., F.I.C.; Sir Christopher Clayton, Kt., C.B.E., J.P.; W. A. Damon, B.Sc., F.I.C.; Prof. A. C. G. Egerton, M.A., Sec.R.S.; Margaret Fishenden, D.Sc.; Sir Francis Goodenough, Kt., C.B.E.; A. T. Green, F.I.C.; Sir Harold Hartley, Kt., C.B.E., M.A., F.R.S.; Harold Hartley, D. Sc.; James Jamieson; Frank H. Jones; Prof. C. H. Lander, C.B.E., D.Sc.; H. Combie, Sc.D.; J. W. McLusky; Prof. Sir Gilbert Morgan, O.B.E., F.R.S., D.Sc.; A. Parker, D.Sc., F.I.C.; F. B. Richards, M.B.E., M.Inst.C.E., M.I.Mech.E.; F. S. Sinnatt, C.B., M.B.E., D.Sc., F.R.S.; Sir Frank E. Smith, K.C.B., C.B.E., D.Sc., F.R.S.; J. W. T. Walsh, D.Sc.; C. M, Walter, D.Sc.; Henry Woodall, J.P.

National Gas Council Nominees:

President (*ex officio*); Sir David Milne-Watson, Bt., M.A., D.L., LL.D.; W. J. Sandeman, J.P.; A. W. Smith.

British Commercial Gas Association Nominees:

President (*ex officio*); A. M. Paddon; T. P. Ridley; J. Sandon Stubbs.

Society of British Gas Industries Nominees:

Chairman (*ex officio*); Ernest West; C. G. Langford; R. J. Rogers.

The Advisory Committee on Research held its third annual Meeting on 5th December, 1938.

The Committee meets to receive and consider the Annual Report of the Research Executive Committee and to discuss, on broad lines, the research requirements of the Gas Industry. For the guidance of the Research Executive Committee, it reviews the trend of technical development in all its aspects, but it has no responsibility for the details of research, personnel, finance or organization.

Domestic Heating Committee

The membership of the Domestic Heating Committee is:

Stephen Lacey, B.Sc., M.Inst.C.E. (*Chairman*); J. E. Davis; Harold Hartley, D.Sc.; F. O. Hawes; C. A. Masterman, M.A., M.I.Mech.E., F.I.C.; E. W. Smith, C.B.E., D.Sc., F.I.C.; the President, two Vice-Presidents and the Honorary Secretary of the Institution (*ex officio*).

Society of British Gas Industries Nominees:

H. Angus, M.Sc., Ph.D.; T. F. C. Potterton.

The Domestic Heating Committee was appointed in December, 1938, to explore the practical application of different fuels for domestic heating.

The Committee is pleased to record the helpful co-operation of the Society of British Gas Industries, which is directly represented on the Committee, and the fact that it has also been possible to obtain the active collaboration of Dr. Margaret Fishenden (London).

Gas Works Safety Rules Committee.

The membership of the Gas Works Safety Rules Committee is:

F. M. Birks, O.B.E., M.I.Mech.E. (*Chairman*); H. E. Bloor, B.Sc., B.Eng.; J. R. Bradshaw, B.Sc., Eng.; J. M. Campbell, J.P.; Thomas Carmichael, J.P., M.Inst.C.E.; J. E. Davis; Thomas Hardie, M.Inst.C.E.; H. Hollings, D.Sc.; James Jamieson; J. W. Napier, M.B.E.; George C. Pearson, M.Inst.C.E.; T. F. E. Rhead, M.Sc., F.I.C.; C. S. Shapley, M.I.Mech.E.; Harold C. Smith, J.P., M.Inst.C.E.; E. G. Stewart; E. B. Tomlinson; the President, the two Vice-Presidents and the Honorary Secretary of the Institution (*ex officio*). Co-opted: L. F. Stemp, B.A., LL.B.

The Gas Works Safety Rules Committee has continued to review technical matters relating to the safe operation of gas works processes. It is satisfactory to note that accidents at Gas Works during the past year have been few and of a minor character.

As a result of joint action taken by The Institution of Gas Engineers and the National Gas Council, collective exemption has been granted by H.M. Chief Inspector of Factories from the application to the Gas Industry of Sections 27(b) (water-sealed and piston-type gasholders) and 28(4) (welding of water-sealed gasholders and cutting and welding of wrought iron gas mains) of the Factories Act, 1937. (Certificates of Exemption No. 4 (General) and No. 5 (General) respectively.)

The Committee has reviewed the technical Sections of the Civil Defence Act, 1939, and more particularly those included in Part VI, "Obscuration of Lights and Camouflage." It appointed a Sub-Committee on Processes involving Flames or Glare, which included representatives of the Board of Trade and of the Air Raid Precautions Department of the Home Office, to consider in detail the requirements of Section 44(i) of the Act. The Sub-Committee prepared, for the guidance of Gas Undertakings and of the Board of Trade, a Memorandum on the Elimination or Screening of Flames or Glare. This Memorandum, which indicates general methods for eliminating or screening flames or glare at Gas Works, has been sent by the Board of Trade to all Gas Undertakings. Additional copies can be obtained on application to the Secretary of the Institution.

The matter is still receiving the attention of the Committee, particularly methods of screening the flames from stacks of water gas plant. Where a relief holder is available it may be possible to arrange not to use the water gas plant during hours of darkness.

The Committee also wishes to draw the attention of all Gas Undertakings to their obligation under Regulation 36 of the Defence Regulations, 1939, Statutory Rules and Orders, 1939, No. 927. This regulation requires that "no vessel situated

wholly or partly above ground and having a capacity of more than five hundred gallons shall, in any premises, be used for keeping any liquid to which this Regulation applies, unless the vessel is surrounded by a wall, embankment or excavation so constructed and situated as to prevent, so far as reasonably practicable, the escape of the liquid by reason of damage done to the vessel in consequence of war operations." This applies to inflammable liquids, *inter alia*, hydrocarbons such as benzine, petrol, naphtha, white spirit, paraffin, kerosene, turpentine, cyclohexane, benzene, toluene, xylene, and carbon bisulphide.

The Committee has continued to co-operate with the Air Raid Precautions Department of the Home Office in regard to the technical aspects of Air Raid Precautions for Gas Works. In March, 1939, with the approval of the Department, the Presidential Address, on Air Raid Precautions, of Mr. G. C. Pearson (Birmingham) to the Midland Association of Gas Engineers and Managers was made available through the Institution to the Industry. More than 1,000 copies of the Address were so distributed.

After consultation with the Factory Department of the Home Office a new Gasholder Record Sheet No. IGE/WSG/8/1 was issued by the Institution to comply with Section 33(2) of the Factories Act, 1937, as prescribed in Statutory Rules and Orders, 1938, No. 598. Over 8,000 of these Sheets have been supplied to Gas Undertakings. The Committee has also approved for publication a set of Record Sheets for high-pressure holders which it is hoped to make available to the Industry at an early date.

The Committee recommends that Gasholder Record Sheets Nos. WSG/2-8 (inclusive) should bear the actual date of the inspection and should be held to cover a period ending two years from that date.

An investigation of the stresses in spirally-guided gasholders is being conducted on behalf of The Institution of Gas Engineers at the National Physical Laboratory. Tests on a model in the 3 ft. wind tunnel have given encouraging results and it has been decided to continue the investigation on a larger model in the open jet wind tunnel at the Laboratory. It is anticipated that observations on this larger model will make possible the extrapolation of the results to full scale.

Contact has been maintained with relevant British Standard Institution Committees, in particular with those dealing with Personal Safety Equipment and Coupling Guards for Machinery.

Joint Lighting Committee

The membership of the Joint Lighting Committee for 1938-39 was as follows:

Institution Nominees: George Dixon, B.Eng., M.Inst.C.E. (*Chairman*); A. Maurice Bell; W. J. A. Butterfield, M.A., F.I.C.; W. J. G. Davey, B.Sc.; Harold Davies; J. E. Davis; E. V. Evans, O.B.E., F.I.C.; J. Weatherall Foreman; A. G. Higgins; A. L. Holton; James Jamieson; Stephen Lacey, B.Sc., M.Inst.C.E.; A. R. McGibbon; C. A. Masterman, M.A., M.I.Mech.E., F.I.C.; F. C. Smith; C. I. Winstone.

Society of British Gas Industries Nominees: W. R. Edgar; Colonel C. J. Falk; F. J. Gould; J. H. G. Horstmann; C. H. A. Kempton; R. J. Rogers; H. R. Stevenson; Philip H. Sugg.

Affiliated District Gas Association Nominees: James Dickson (North British); E. M. Edwards (Wales and Monmouthshire); E. Howard (Midland); H. W. Saville (Irish); H. Singleton (Manchester); W. S. Stredwick (Southern); J. E. White (North of England); George Wright (Eastern Counties).

Ex officio: The President, the two Vice-Presidents and the Honorary Secretary of the Institution.

The Joint Lighting Committee has received with regret the resignation of Mr. Stephen Lacey (London) from the Chairmanship of the Committee, but is pleased to record that Mr. George Dixon (Nottingham) has accepted the Chairmanship in his place. Its thanks are due to Mr. Stephen Lacey for his services as Chairman for several years.

The Committee has given special attention to the provisions of the Factories Act, 1937, relating to factory lighting and has collaborated with the British Commercial Gas Association in the preparation of a booklet entitled "Light on Industry," to show how gas lighting can be used successfully to provide adequate standards of lighting in factories in accordance with the recommendation of the Fourth Report of the Departmental Committee of the Home Office on Lighting in Factories. On May 17, 1939, a letter signed by the Chairman was sent to all Gas Undertakings, drawing attention to (i) a leaflet issued by the Factory Department of the Home Office on "Lighting in Factories; Minimum Standards" (Form 282, March, 1939); (ii) the above-mentioned booklet "Light on Industry"; and (iii) a Memorandum issued by the Air Raid Precautions Department of the Home Office on "War Time Lighting Restrictions for Industrial and Commercial Premises."

The Committee has continued to review the cost of gas and electric lighting. The present Government regulations allow no street lighting during hostilities. If later any relaxation of black-out restrictions were allowed, as for instance, some form of dimmed lighting at important points to aid traffic movement, the possibility of using gas lighting for such purposes should be borne in mind. In this connexion the Committee wishes to draw particular attention to screened gas-lighted guard posts, provided with cut-off valves, for use on street refuges, etc. These cut-off valves ensure that in the event of damage by vehicular traffic the gas supply would be automatically cut off and danger of ignition of the gas avoided. Further particulars of these cut-off valves may be obtained on application to the Secretary of the Institution.

A representative delegation of the British Gas Industry, led by Mr. W. J. A. Butterfield (London), attended the Plenary Meeting of the International Commission on Illumination at Scheveningen, Holland, from June 12 to 20, 1939.

The Committee continues to maintain close contact with the Illuminating Engineering Society and the Association of Public Lighting Engineers.

Liquor Effluents and Ammonia Committee

The membership of the Liquor Effluents and Ammonia Committee is:

C. F. Botley, M.Inst.C.E. (*Chairman*); T. Lewis Bailey, Ph.D., F.I.C.; H. T. Calvert, M.B.E., D.Sc., Ph.D., F.I.C.; W. A. Damon, B.Sc., F.I.C.; E. V. Evans, O.B.E., F.I.C.; H. Hollings, D.Sc.; P. N. Langford; P. G. G. Moon, M.Inst.C.E.; A. Parker, D.Sc., F.I.C.; P. Parrish, F.I.C.; E. W. Smith, C.B.E., D.Sc., F.I.C.; W. W. Townsend; J. Wilkinson, O.B.E.; Prof. J. W. Cobb, C.B.E., B.Sc., F.I.C. (*Honorary Secretary*); the President, the two Vice-Presidents and the Honorary Secretary of the Institution (*ex officio*). *Co-opted:* Leslie F. Stemp, B.A., LL.B.

The Committee has continued to meet during the year, but has conducted no special investigations or research. Dr. Arthur Key (Research Chemist) has been engaged on other investigations at Leeds University, but his services have been available to the Committee when required.

The Committee has been particularly concerned during the past year with the negotiations between various Gas Undertakings and Local Authorities in regard to the disposal of their effluent through the public sewers under the Public Health (Drainage of Trade Premises) Act, 1937, which came into force on 1st July, 1938.

The Committee hopes that all Undertakings which may be negotiating with their Local Authority, or which may be approached by their Local Authority in regard to the disposal of their effluent, will first consult the Committee before concluding any agreement or agreeing to any proposed By-Laws under the Act. If this is done it may be possible to obtain for the Gas Industry reasonably uniform terms for the disposal of effluent. At the same time the Committee cannot stress too strongly, and would bring this particularly to the attention of Holding Companies, the desirability of either recovering ammonia directly as sulphate or of arranging for the working up of crude liquor at centralized concentrated liquor plant.

Amongst Gas Undertakings which have been assisted by the Committee has been one which desired to discharge effluent liquor from a concentrated liquor plant to the public sewers and which had to meet many objections raised by the Local Authority. The draft agreement originally submitted by that body contained objectionable and onerous clauses, but it has been possible to modify these clauses to the satisfaction of the Gas Undertaking.

Another Undertaking, which has for some time sought to obtain permission to discharge effluent to the sewers, has been advised to take advantage of the Public Health (Drainage of

Trade Premises) Act, 1937, and serve a Trade Effluent Notice on the Local Authority.

It is a pleasure to record that a representative of the Committee now serves on behalf of the Coking and Gas Industries on the West Yorkshire (Non-Textile) Trade Effluent Committee.

Since its publication on 1st November, 1938, 521 copies of "Gas Works Effluents and Ammonia," by Dr. Arthur Key, have been sold up to 30th September, 1939.

Meters Committee

The membership of the Meters Committee is:

John Terrace, M.Inst.C.E. (*Chairman*); H. E. Bennet, M.C.; R. J. H. Clark; C. M. Croft, M.Inst.C.E., M.I.Mech.E.; H. W. Hodgson; Stephen Lacey, B.Sc., M.Inst.C.E.; L. F. McLeod, O.B.E.; J. W. McLusky; R. G. Marsh; C. A. Masterman, M.A., M.I.Mech.E., F.I.C.; W. J. Sandeman, J.P.; C. S. Shapley, M.I.Mech.E.; the President, the two Vice-Presidents and the Honorary Secretary of the Institution (*ex officio*).

The Meters Committee has met to consider matters of current interest in regard to gas meters and, *inter alia*, has reviewed present practice in the use of cut-out valves for prepayment meter gas supplies.

Pipes Committee

The membership of the Pipes Committee is:

H. J. Escreet, B.Sc., Eng. (*Chairman*); F. Boardman, M.I.Mech.E.; L. F. McLeod, O.B.E.; R. G. Marsh; S. T. S. Musgrove; the President, the two Vice-Presidents and the Honorary Secretary of the Institution (*ex officio*).

The Pipes Committee has continued to maintain contact with other organizations and Government Departments having common interests.

The Committee has held a meeting in Birmingham where, through the courtesy of the City of Birmingham Gas Department, it was given a practical demonstration of the use of the apparatus devised by Mr. R. G. Marsh (Birmingham) for bagging off large mains in emergency.

The Committee has considered the corrosion of wrought iron and mild steel used for gas supply services. One Gas Undertaking asked for information regarding corrosion on the outside of the bend of wrought iron supply pipes. It appears from the present knowledge of the subject that fatigue of the metal due to straining does not affect its susceptibility to corrosion. On the other hand there is no information regarding the possible effect of crystal deformation in its relationship to susceptibility to corrosion.

Interesting samples of a 12-in. cast iron gas main laid in 1865 were submitted to the Committee. These samples showed that the main was still in very good condition after being in use for 74 years.

Refractory Materials Joint Committee

The membership of the Refractory Materials Joint Committee is:

Institution Nominees: T. F. E. Rhead, M.Sc., F.I.C. (*Chairman*); A. Edwards; P. C. Gardiner, F.I.C.; W. T. Gardner; W. Grogono.

Society of British Gas Industries Nominees: T. Allen; F. H. Brooke; John L. Butler; W. J. Gardner; C. R. F. Threlfall, M.C., M.A.

British Refractories Research Association Nominees: Colonel C. W. Thomas; Frank West.

Ex officio: The President, the two Vice-Presidents and the Honorary Secretary of the Institution, and A. T. Green, F.I.C. (Director of Research, British Refractories Research Association).

Co-opted: F. H. Clews, M.Sc., A.I.C.; H. G. Colman, D.Sc., Ph.D., F.I.C.

The Committee has to report with regret the resignation of the chairman, Mr Walter Grogono (Croydon). It desires to record its appreciation of the services of Mr. Grogono during his Chairmanship.

Manchester's Gas Price

The City of Manchester Gas Department has issued the following Press notice in connexion with the Department's position arising out of war conditions:

"The Committee approved a recommendation to the City Council to increase the price of gas by 1.78d. per therm, equivalent to 8d. per 1,000 cu.ft., the increase to operate as and from the next reading of the meters.

"The reasons for recommending the City Council to take this step are as follows:

(1) The reduction of revenue due to the immediate cessation on the outbreak of war of street lighting, outside shop lighting, &c.

(2) The evacuation from the City areas of a considerable number of consumers.

(3) The effect of the Fuel and Lighting Order introduced on Sept. 7 last, which although subsequently amended so as to increase the ration to 100%, has left its influence.

"It is estimated that the sales of gas will fall by 15% (approximately 1,000 million cu.ft.) for a full year due to these factors. Street lighting accounts for 9½%.

"The Department is already meeting increased expenditure in respect of coal, materials, taxation, and works in connexion with Air Raid Precautions and Civil Defence.

"It has been possible to make certain savings to counteract the increased costs by means of a reduction in capital expenditure and publicity costs together with the realization of slightly better prices for residuals.

"The Gas Committee greatly regrets to have to make this recommendation having regard to the successful policy adopted during recent years. Unfortunately, coal prices have risen steeply since the Coal Selling Schemes were introduced in 1935, and the increase in the coal bill is now £104,000 a year, equivalent to 4d. per 1,000 cu.ft. Notwithstanding this very considerable increase, the price of gas has not been advanced.

"At the end of March, 1939, an increase in the production of gas to 134 million cu.ft. over the previous year had been recorded and from April 1, 1939, to the end of August last the sales of gas were showing an increase of 62 million cu.ft., equivalent to 2.6%, over the corresponding period last year. It was confidently anticipated that by the end of the year the increase would have been at least 200 million cu.ft., equivalent to 3%, and that a surplus on the year's trading would have resulted.

"The cost of the increase to the small consumer will be approximately 2d. per week."

London and Southern District Junior Gas Association

The Opening Meeting of the London and Southern District Junior Gas Association was held on Oct. 28 at Gas Industry House, and a report of the proceedings has now been made available for publication.

The chair was taken by Mr. S. C. Waldock (Gas Light and Coke Company), the retiring President, and the Assistant Hon. Secretary (Mr. H. J. Risby) read the minutes of the last General Meeting, which were confirmed and signed.

Mr. Waldock then introduced the new President, Mr. F. O. Hawes (Tottenham), and transferred to him the Presidential Collar. He wished Mr. Hawes a successful year of office and hoped that present conditions would give place to more normal ones before its conclusion.

Mr. Hawes then made a "token" presentation to Mr. Waldock who had been prevented from making a definite selection in time for the meeting. Acknowledging the presentation, Mr. Waldock said that he did not need a reminder of his year of office which had been a very enjoyable one.

The President then welcomed new members and announced that a letter had been received from Mr. R. J. Milbourne regretting that he was unable to be present. In his absence, the Milbourne Silver Medal was presented by the President to Mr. G. Dougill (Gas Light and Coke) for his Paper on "A Serious Case of Corrosion and its Cure." This was selected as the best paper presented by a member during the previous session.

Mr. Dougill, returning thanks, said that the preparation of the Paper had enabled him to link up a number of isolated results the value of which might not otherwise have been realized.

Mr. Hawes then read his Presidential Address, which was published in last week's "Journal." A vote of thanks to the President was proposed by Mr. J. Grayston (Romford), who remarked how pleased he was that Mr. Hawes had pointed out the need for preparation for future developments. Mr. F. C. Smith (Gas Light and Coke), seconding, also emphasized the need for Juniors to look forward and made an appeal for the continuation of research work.

Mr. Hawes duly responded, and then opened the meeting for discussion of arrangements for the rest of the session. It was agreed to hold an informal meeting on Saturday, Nov. 25, at 3 p.m., at Gas Industry House and to continue to fix one meeting at a time.

The Melchett Lecture

Supply of Explosives During the War and the Early History of Billingham

By
H. A. Humphrey

Presented to the Institute of Fuel on October 9.

THE subject chosen deals with a very perfect kind of fuel which burns more rapidly than pulverized coal and may leave no ash or produce any smoke. It is the fuel of that highly developed one-stroke cycle internal-combustion engine known as the modern gun. In other words, I want to tell you about the production of explosives during the Great War.

The choice is justified because the subject has interest, significance, and importance for to-day and for the future. It deals with the work of the company with which the first President of this Institute was most intimately associated. It enables me to present the early history of a scheme of national importance which I had the opportunity of guiding and assisting through its most critical days, and it provides a vital chapter in the history of the Great War which has not been given publicity.

The supply of explosives was under the Ministry of Munitions and was the concern of the Department of Explosives Supply (D.E.S.), of which Lord Moulton was the head. I entered that department as a volunteer, and was appointed an Assistant Director of the D.E.S. and technical adviser for two sections of the D.E.S., one relating to the purification of trinitrotoluene (T.N.T.) and the other to the production of ammonium nitrate. Having been in charge of these sections, I can speak from first-hand information assisted by a full day-to-day diary which I kept throughout the period concerned.

Use of Amatol

At the outbreak of the Great War the desire of the British Government to assist the French led to the decision that as much of our production of lyddite as could be spared should be sent to France, and that, for our own service requirements, we should develop and extend the use of amatol. This latter explosive is a mixture of ammonium nitrate and T.N.T. For most purposes it was standardized as an 80:20 mixture, so that the bulk ingredient of the high explosives used by our Army was ammonium nitrate.

Crude T.N.T. was being imported from America, and was also being made at several works in England and Scotland. Later, a large factory was erected in Scotland for greatly increasing the output. The crude T.N.T. from different sources differed in crystalline structure, in melting-point and in impurities. The necessity for bringing it all up to a standard specification was most pressing, and it happened to be the first task that Lord Moulton asked me to undertake.

Investigation showed that the pre-war purification plant having the greatest output, and yielding the most pure material, was using benzole in the process, and the extreme care needed to operate such a process without accidents rendered it useless as a war-time proposition when only rough unskilled labour was available; moreover, the time for purification was 3½ days.

I applied to Messrs. Brunner Mond & Co. for help, and they kindly lent me the services of Captain (later Major) F. A. Freeth and Mr. L. A. Munro to work out a better process adaptable to war needs. In this they quickly achieved success, and I was instructed to extend a factory at Rainham to operate the process. I designed the plant, placed the contracts, and erected the works. It was a success from the start, and it is indicative of the state of affairs at that time that when the purified T.N.T. was passed to the Service for use I received a peremptory message to attend before an elderly general at Whitehall, who roundly upbraided me for having built a factory without first obtaining financial sanction and, incidentally, for having installed too many w.c.s for the number of men employed.

Having proved the value of the new process, we were confronted with the problem of extending it on a large scale. The officials of Messrs. Brunner Mond & Co. were called to a conference on June 5, 1915, and they agreed to convert their soda crystal plant at Silvertown into a crude T.N.T. purification plant in spite of the loss of trade such a step involved. The necessary alterations to the plant were completed, and the plant was put into operation in September of that year. After preliminary difficulties had been overcome the plant was successful, and the period for purification was reduced to four hours.

The continued researches of B. M. & Co. brought about a still better process, and after Lord Moulton and I had carefully investigated it we came to the conclusion that it was again essential to seek the co-operation of B. M. & Co., and ask them to provide designs and staff for erecting and operating a central purification plant to which the crude T.N.T. from all producing works could be sent for purification. I was instructed to see the B. M. & Co. officials and, if possible, to arrange for this scheme to be carried out.

In spite of their directors and staff being already overworked, for reasons which will appear later, B. M. & Co. did agree. A central works was designed and the work commenced at Gadbrook early in November, 1915. It was deemed essential that this plant should be as free from combustible material as possible, and it was, therefore, constructed in steel and concrete, and for safety it was spread out along a frontage of a quarter of a mile. The first unit started output in February, 1916.

The Silvertown Explosion

It was most unfortunate that a fire which started in the roof of one of the sheds at Silvertown caused an explosion which completely destroyed the works, caused loss of life, and wrecked much surrounding property. It was subsequently proved that the fire was due to the formation of a little-known self-igniting chemical compound formed as dust under the roof.

I turn now to the production of ammonium nitrate, the demands for which grew so rapidly and reached such huge proportions that it was a continuous and arduous struggle to keep pace with the needs.

The peace-time production of ammonium nitrate before the war was only 30 tons per month, and I shall tell you how this was increased and multiplied over and over again, until it reached thousands of tons per week. Messrs. Chance & Hunt offered the D.E.S. to supply 25 to 30 tons per week by neutralizing nitric acid with ammonia gas, and subsequently increased their output to 80 tons per week. The Gas Light and Coke Company were able to supply five tons per week by neutralizing nitric acid with ammonia liquor, and the United Alkali Company entered into contracts to supply 56 tons per week by the same process.

These supplies were utterly inadequate to meet the rapidly increasing demand for explosives, and Lord Moulton was faced with the urgent problem of finding a new source of supply. Some 1,000 tons per month of 70% calcium nitrate could be obtained from Norway, and it was decided to import this material and convert it to ammonium nitrate. Messrs. Brunner Mond & Co. were once more approached to devise a suitable process and to undertake the conversion. On March 11, 1915, they agreed to convert 100 tons a week. They hastily provided the necessary plant and on March 24 the first consignment of Norwegian calcium nitrate arrived. On April 6 the first charge was subjected to the new process and during April 40 tons of ammonium nitrate was despatched. As the process became established, Brunner Mond's contracts were increased to 300 tons per week, and the extra plant needed was added as quickly as possible.

The explosives programme was not being met—more ammonium nitrate had to be obtained. Messrs. B. M. & Co. had patented a process for the manufacture of ammonium nitrate along lines similar to their ammonia soda process. It consisted in ammoniating a strong solution of sodium nitrate, blowing CO_2 gas through this to obtain bicarbonate of soda as a precipitate, and ammonium nitrate in solution. The solution after separation was to be cooled to deposit solid ammonium nitrate.

On July 28, 1915, I was sent to Winnington to request B. M. & Co. to increase their output of ammonium nitrate by 1,000 tons per week if possible. Two days later, Mr. (later Sir John) Jarmay, one of their directors, attended a conference in London and agreed to endeavour to meet this proposal, which brought their output up to 1,400 tons per week by both processes.

Sodium nitrate could be imported from Chile, but it was too impure for use, and B. M. & Co. suggested that the Salt Union were well adapted to undertake the purification. Accordingly, I visited the Salt Union headquarters and they agreed to undertake this portion of the work.

On August 15 the first solid ammonium nitrate made by the ammonia soda process was obtained, but a number of serious difficulties had arisen. I kept in the closest touch with B. M. & Co., and so witnessed a great struggle to overcome the difficulties in which Mr. Jarmay, Mr. Glendinning, Captain Freeth, and others were working with all their might and main. This struggle lasted right through to the end of 1915 and at times looked hopeless.

Ammonia Plant at Gas-Works

In the meantime the difficulty of obtaining enough ammonia presented a serious problem, and a conference was called in London with reference to the purchase of sulphate of ammonia and of ammonia liquor, with the result that Messrs. B. M. & Co. were appointed agents to purchase ammonia liquor and to supervise the erection of a number of plants at gas-works and coke ovens, &c., where ammonia could be concentrated to 25% solution for transport to B. M. & Co.'s works.

To assist this work I called a conference of managers of gas-works and coke oven plants, which met in Sheffield, where I explained the proposals, the plant needed, the help they would receive, and the urgency of the task.

The Salt Union did some fine work in designing and erecting a suitable mechanical washing plant for raw sodium nitrate, and they kept on adding new units until their capacity reached 1,500 tons output per week; but the difficulties in the ammonia soda process were not yet solved, and B. M. & Co. had reluctantly to report to Lord Moulton that the large output aimed at could not be reached.

In the midst of great anxiety my department received an offer from the Ammonia Soda Co. to manufacture calcium nitrate, and then convert it to ammonium nitrate. Trials had been made on the scale of 1 ton per week. After careful investigation a contract was entered into for the manufacture of 150 tons per week.

Early in 1916 it become possible for B. M. & Co. to acquire a controlling interest in the Ammonia Soda Co. and this enabled their own chemists to set to work to improve the process. Originally double crystallization of the calcium nitrate was necessary, but under the improved process only one crystallization was needed.

Early in 1916 a review of the whole position of ammonium nitrate made it quite clear that a radical change in the programme of manufacture would be necessary. On Jan. 10 I made an important report to Lord Moulton outlining all the difficulties which had been encountered in the ammonia soda process and giving reasons why a much greater output should be obtained from the calcium nitrate conversion process. Approximate estimates were obtained for the erection of the proposed new works, and the whole matter was brought to the notice of the Minister of Munitions, and a grant of £500,000 was obtained to carry out the scheme.

A Programme of Extension

On Jan. 8, 1916, I accompanied Lord Moulton to Cheshire to meet the B. M. & Co. directors and the staff concerned, and a definite programme of extension was arranged—namely, that the 150-ton plant at Plumley works should be increased to 450 tons per week, and that a new plant should be erected on the site of the Victoria Salt works to produce 1,500 tons per week.

Reverting to the ammonia soda process, Captain Freeth was bringing all his indomitable energy to overcome the difficulties. I followed these efforts with encouragement and sympathy, and eventually became convinced that given time and some changes and addition to the plant it would eventually be successful. I therefore urged that the process should receive every assistance as an important potential producer. From an output of 6 tons per day, the figure for March, 1916, rose to 20 tons, and in May to 32 tons per day. With this success in view, I approached Lord Moulton on May 24 to get B. M. & Co. to produce 80 tons per day. They erected the additional plant for this and were ultimately able to achieve the desired output.

B. M. & Co. were asked to become consulting engineers to the Government for the design of the plant required for the Victoria works, and as the burden of ever-increasing work overtook the capacity of their large but limited staff, part of this burden had to be removed, and the work of looking after the concentration of ammonia liquor, by this time an important work in itself, was transferred to others. At this time they were responsible for the enlarged programme at four factories.

B. M. & Co. had intended to convert the whole of the calcium nitrate into ammonium nitrate at their Lostock works, but as the ammonium soda process output increased, so the conversion plant had to be extended. Eventually it was decided that B. M. & Co. should adapt their Sandbach works to serve as a conversion plant.

Again the burden of B. M. & Co. had to be eased, and the conversion of Norwegian calcium nitrate was transferred to the United Alkali Co., who erected a plant at their Fleetwood works for 70 tons per week and then more than doubled it. Later on the Fleetwood programme and the B. M. & Co. programme had again to be extended to provide the continuous demand for more and more high explosives. I remember one week in which 7,000 tons of ammonium nitrate was packed at the Lostock works alone.

Although B. M. & Co.'s Cheshire works were crowded with war-work plant, their contributions to the prosecution of the Great War were not ended. Two of their chemists, Captain F. A. Freeth and H. E. Cocksedge, patented a process for making ammonium nitrate from sodium nitrate and ammonium sulphate. After the outbreak of war a semi-technical plant to prove the process revealed unexpected difficulties due to certain meta-stable equilibria. To help on the good work the process was again tried in 1916 under altered conditions, and later a large scale experiment at Sandbach led to such favourable results that Lord Moulton welcomed the process as another means of keeping up supplies.

The proposed new factory for the new process was to be erected at Swindon, and I went there and found a suitable site; but there was the problem of who was to erect the works. This was solved by a visit I paid to the Chief Engineer of the Office of Works—Sir Frank Baines—who gave me a list of all the factories his department had built for the Government, and ended by offering to take B. M. & Co.'s plant designs and to build a complete works. I communicated this offer to Lord Moulton, who gladly accepted it. The works started production on Sept. 5, 1917, and were closed down on the cessation of hostilities in November, 1918, having produced over 23,000 tons of ammonium nitrate. Here again the serious difficulties encountered in the new process were

overcome by B. M. & Co.'s chemists, but the fight was a hard one.

Still another effort by B. M. & Co. must be recorded, for they entered the field of producing synthetic phenol for the manufacture of picric acid under the very able direction of Mr. A. W. Tangye. It was a complicated process, starting with benzole and involving the use of concentrated oil of vitriol, calcium oxide, sodium carbonate, caustic soda and carbonic acid. Mr. Tangye worked out the flow sheet, designed the plant, and ran it with success. It formed a very valuable addition to the explosives programme.

The capital expenditure involved in the provision of works for the purification of T.N.T. and for the manufacture of ammonium nitrate was approximately £6,000,000.

However simply I may have related the facts presented, it is not possible to disguise the paramount importance of the services rendered by B. M. & Co. to the nation. Indeed, Lord Moulton, in conversation with me, said their services were "indispensable to the success of the Allies."

The Early History of Billingham.

The second half of my lecture follows naturally from the first, and it might well be described as "The Fight for the Billingham Scheme." A fight which at one time was nearly lost, but because it was not lost a great national asset exists to-day, which places this country in an immensely better position as regards explosives supply should we be involved in another war.

In July, 1917, the work I had been doing eased off, as there were then no more factories to be erected in the immediate future. It was decided that I should be transferred from D.E.S. to be chief engineer to the Munitions Inventions Department (M.I.D.), and the story begins with my transfer in August, 1917.

My work there was at first chiefly concerned in assisting Mr. R. T. G. French in the preparation of data, calculations, and estimates for the very valuable set of reports issued by the Nitrogen Products Committee, covering all the sources of power production and the technical processes which could be of national service during war.

However, in view of the continued shortage of ammonia, I was called upon to prepare plans, specifications, and estimates for a carbide-cyanamide factory to produce 66,000 tons of cyanamide per annum, and to convert half the final ammonia to nitric acid. Working in conjunction with the M.I.D. was a splendid body of chemists and physicists, headed by Lieutenant H. C. Greenwood, and including Dr. Rideal and Captain Partington. At University College they had a small experimental plant producing synthetic ammonia by the Haber process, which had attained a fair measure of success.

The D.E.S. had to consider a choice between the cyanamide process and the Haber process, and decided to erect a Haber plant at Billingham to produce 60,000 tons of ammonium nitrate per annum.

Dr. J. A. Harker was chief chemist at M.I.D., and he and I discussed the D.E.S. proposals regarding Billingham, and decided that the information available, and the experimental stage reached at University College, did not warrant the employment of this process as a war measure. Accordingly we wrote a report to D.E.S. setting out our reasons why the cyanamide process should be preferred as a practical scheme. The D.E.S. decided, however, to continue with the Haber scheme, and thereafter we lent them such aid as we could.

When over a million pounds had been spent on the Billingham scheme it was found necessary to ask the Finance Department for £50,000 to carry out experimental work before certain portions of the plant could be designed. Subsequently the scheme was placed in abeyance, and when the war ended no technical plant had been erected.

New Nitric Acid Process

I had invented and patented a new process for the manufacture of nitric acid, and my patent was transferred as a secret process to the Secretary of State for War, who had it patented in foreign countries. I was still engaged on this and other work when the Armistice was signed, and all kinds of work had to be cleared up.

In January, 1919, the Nitrogen Products Committee, to which the consideration of the Billingham scheme had been referred, passed the following minute:

> "Mr. Humphrey should be authorized to get all the necessary documents and drawings from the D.E.S., see the contracts, note all the facts and figures, make a digest of the information for the Committee, and also submit a programme with some idea of cost."

The official authority was received on Jan. 13, 1919, and I at once set to work. On Jan. 22, I paid my first visit to Billingham, taking with me a representative of the Office of Works for reasons I shall refer to later. On Feb. 7, I attended a meeting of the Nitrogen Products Committee, presented my report of 57 pages, and explained my proposals. Put shortly, my recommendations agreed with suggestions previously made by the Nitrogen Products Committee of which the Minister of Munitions had also been in favour—namely, that the scheme should be prosecuted as a Government undertaking. I advised reducing the scheme to 10,000 tons of ammonia per annum, with ammonium sulphate as the end product, and pointed out all the changes in plant and layout which would be involved. Estimates for the revised scheme were given, and I explained that I had already secured from the Office of Works a promise to complete the buildings and services required, and from M.I.D. the full co-operation of their staff in designing the plant, should such services be required.

Copies of my report were sent to the Minister, to Lord Moulton, and to other departments concerned. A cleavage of opinion was at once apparent. The verdict of those whose opinions carried the greatest weight were adverse to any Government scheme. There was a strong desire to close down the whole scheme and realize such assets as were available—in fact, to treat it as other D.E.S. factories were then being treated.

The Controller of M.I.D., Admiral Sir Reginald Bacon, was opposed to the Government scheme, and in an interview with him on Feb. 21, I asked him if he would support the technical proposals I had recommended if the scheme could be undertaken by private enterprise. He said he would, in spite of the fact that the Nitrogen Products Committee had sent a note to the Minister saying that such a course "would be fatal to the eventual success of the scheme." I suggested approaching Messrs. Brunner Mond & Co. and Nobel Industries, and on further discussion Messrs. Vickers, Ltd., were included. The Controller, however, said that such a suggestion could not come officially from M.I.D., but if I could find means of approaching the three firms I might do so.

Lord Moulton heartily concurred and agreed to approach B. M. & Co. on the subject. I recruited all the influential help I could, and especially that of the previous Controller of M.I.D.—Colonel Sir Henry Goold Adams—who gave most valuable assistance not only on the main subject but also in my efforts to keep the staff at University College from dispersing. Orders that all the experimental Haber plant had to be removed from University College caused me to apply to many quarters before I could find hospitality from the Northern Polytechnic for its accommodation.

On Feb. 27 I met Messrs. Greenwood, Partington, and Rideal at University College, and urged them and the other members of the group to keep together a little longer, for if the Billingham proposals were realized the whole staff would be needed. The majority did keep together, but Rideal and Partington left.

The Minister had received a minute adverse to the prosecution of the Billingham scheme in any form, and to get over this Lord Moulton had a conference with the Minister on Feb. 28. On the previous day he had seen Sir John Jarmay and asked B. M. & Co. to form a syndicate to operate the Haber process.

On March 7, 1919, Lord Moulton 'phoned me to bring a copy of my Billingham report and meet Mr. Roscoe Brunner, the Chairman of B. M. & Co., at D.E.S. At this interview it was agreed that I should take Mr. A. W. Tangye and Major Freeth to inspect the Billingham site and buildings. On the following day I again met Mr. Roscoe Brunner and got from him a promise to take over the whole M.I.D. staff at University College provided the scheme matured.

On March 19, I met Mr. Tangye, Lt.-Colonel Pollitt, D.S.O., and Mr. Harper (of Messrs. B. M. & Co.) at Darlington, and we proceeded to the Zetland Hotel at Saltburn for a long discussion. Next day we all went to Billingham, where Dr. Docherty (in charge) took us round. A few days later, Mr. Gilmour, of D.E.S., said he could delay selling the Billingham assets for two months but no longer.

March 27 was a very black day for me. Mr. Tangye came to inform me that B. M. & Co. had decided *against* taking up the Billingham scheme. His report setting out B. M. & Co.'s reasons was handed to Lord Moulton. I begged Lord Moulton not to accept this decision as final, but he had not then studied the report and could give me no assurance.

A Visit To Germany

There followed days of anxiety, and in order to make the Billingham scheme appear more practical and attractive I asked Lieut. Greenwood if he would design a synthetic high-pressure ammonia converter on a commercial scale of 20 tons per day output. He agreed, provided he could get Captain Tate released from the Tank Corps to help him. This I contrived to do. There had been a Government mission to German works, including the Haber plant at Oppau, and I told Greenwood he ought to go to Oppau and that I would try to get permission.

Lord Moulton not only got this permission but included a permit for me and one for Colonel Pollitt, D.S.O., if he would join us. Colonel Pollitt came to see me about the proposed visit to Oppau on April 14.

Lord Moulton tried to secure for us all the powers needed to obtain the full benefit from the visit, but for reasons it would take too long to explain, and although Marshal Foch was appealed to, our final permit only allowed our party to roam over the Oppau works, see what we could, but not take any measurements or make any sketches or notes.

I need not describe all our doings at Oppau in spite of their interest. The conditions attached to the visit placed us under a great handicap, but we gathered information under difficulties, and were able to put it together in the shape of a report.

Early in July, 1919, B. M. & Co. had made up its mind to proceed with the Billingham scheme, and on July 10 I met Colonel Pollitt in London, and he told me my services would be needed. On August 27, 1919, I was appointed consulting engineer for the whole Billingham scheme. Being still a Government official, I tendered my resignation, to Sir Graham Greene, K.C.B., at the Ministry because the Controller of M.I.D. had already departed. I was told that Sir Graham had no power to accept my resignation, so being the senior official left at M.I.D. I again wrote out my resignation, addressed it to myself, and replied to myself accepting it.

B. M. & Co. gave me Captain A. H. Cowap as chief engineer, and I was given *carte blanche* to select the very best staff obtainable. I gathered round me a brilliant band of highly trained men, to whom much of the great success which was achieved was due. Also, we had in Colonel Pollitt a splendid leader, who had the spirit and inspiration needed for such a great undertaking, and who later received the Society of Chemical Industry's medal for his important work.

The Fight Won

The fight for the Billingham scheme was won, but at times it looked perilously near to being lost, and appeared to hang on the slender thread of my own efforts to rescue it. In my original report on the Billingham scheme, I wrote "Expensive methods of making ammonium nitrate, depending on imports of Chile nitrate, were adopted during the war, and, as a matter of National insurance, this country must be in a position to produce its war requirements of ammonium nitrate without relying upon imported materials. Germany could not have conducted the war had she not attained such a position."

The Billingham plant was developed in its early stages by Synthetic Ammonia & Nitrates, Ltd., of which I was a director. It was an offshoot of B. M. & Co., and later became absorbed in the combine known as Imperial Chemical Industries, Ltd. Before I left Billingham to become consulting engineer to I.C.I. for all their works, some £25,000,000 had been spent at Billingham.

The Billingham Works cannot be described, they must be seen to be appreciated. They embody a high-pressure technique quite new to this country and involve the handling of vast quantities of red hot combustible gases at a pressure of some 4,000 lb. per sq.in. At Billingham are to be found the largest compressors, the largest water gas plant, and the greatest number of heavy hollow forgings in this country with hundreds of unique features in its many departments. The works cover an area of 1,400 acres and have over 50 miles of railway within their boundary.

The developed high pressure technique made possible its application by I.C.I., Ltd., to the production of oil from coal—a process which has been fully described in a notable paper by Mr. K. Gordon, to be found in the Journal of the Institute of Fuel for November, 1935. My own principal contribution to the process was a patent No. 308995, which embodies the invention of a tall vertical hollow forging, in which the coal-oil mixture is adequately stirred by forcing compressed hydrogen gas through the mixture. Mr. Gordon's paper contains a great amount of valuable information based on experiments on a large scale costing hundreds of thousands of pounds, and I think the Institute of Fuel was very fortunate in that the directors of I.C.I., Ltd., permitted the information to be presented to our members.

Illuminating Engineering Society

Address by the President

Although it was announced some time ago that the Illuminating Engineering Society was not at present arranging any formal programme of meetings, a gathering of Members was called at the E.L.M.A. Lighting Service Bureau, on Nov. 14, when the new President, Mr. F. C. Smith, of Watson House, Gas Light and Coke Company, was inducted. After Mr. Percy Good, the retiring President, had referred in warm terms to Mr. Smith's services to the Society, and had in turn been thanked for his own great efforts on behalf of the Society during his term of office, Mr. F. C. Smith addressed the meeting.

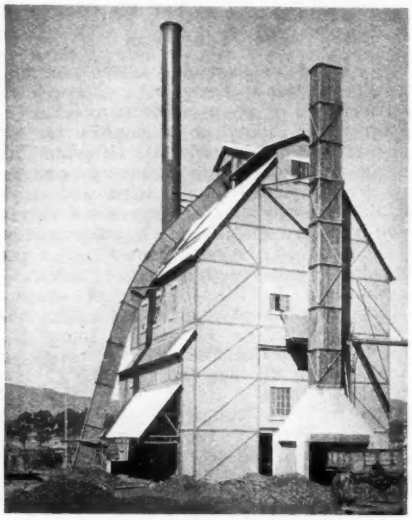
He emphasized the intention of the Council to maintain the activities of the Society during the war period as fully as possible. It was intended to continue the publication of the Transactions and "Light and Lighting." Members who had undertaken the responsibility of preparing Papers were asked to complete them for publication or eventual delivery. Two meetings had already been arranged, the present one and another in December to consider the scheme of Fellowship and the recognition of a class of fully qualified members. There were other meetings in prospect. It was also their aim to maintain the activities of the various Local Centres, most of which he hoped to visit during the coming months.

Proceeding, Mr. Smith explained that the Society had, at an early stage, placed its services at the disposal of the authorities, and their offer had been accepted. A variety of problems had been suggested for their consideration and a great deal of work had already been conducted. This had already resulted in the publication of certain British Standard Specifications, such as those relating to fittings to furnish low and even illumination, and light locks for shops, while other Specifications dealing with fluorescent paints, gauges for checking low illuminations, &c., were approaching completion. About eighty members of the Society were working on 23 Committees, leading to an expenditure of effort already assessed at over 2,000 man-hours. Laboratories attached to gas and electrical organizations were uniting their efforts to accomplish the necessary experimental work.

At the conclusion of the Address, Mr. W. J. Jones referred briefly to various demonstrations at the Bureau, which were afterwards inspected by members present, illustrating the design of fittings (both gas and electric) to furnish low orders of illumination. Light locks for shops, torches and headlights for use under war conditions, and applications of fluorescent paint. Specimens of experimental gauges for checking illumination were exhibited by Mr. C. E. V. Lambert and Col. Kenelm Edgcumbe, the former based on the use of radium luminescent paint, the latter on the illumination of an inclined surface by a small glow lamp fed by a dry battery.

In the course of the Proceedings the Leon Gaster Memorial Premium was awarded to Mr. H. Warren for his Paper on "Research on the Production and Utilization of Light."

C.O.L. Intermittent Verticals in New Zealand



Exterior view of the new C.O.L. Plant at the Works of the Petone & Lower Hutt Gas Lighting Board

The Works of the Petone and Lower Hutt Gas Lighting Board are the sixth largest in New Zealand, and the new carbonizing plant lately constructed there comprises an installation of C.O.L. intermittent vertical chambers of a capacity of 540,000 cu. ft. per diem.

UP to 1936 the carbonizing plant at the works of the Petone & Lower Hutt Gas Lighting Board consisted of hand-charged stop-ended horizontal retorts with a C.W.G. plant as an auxiliary means of gas production.

In 1936, having in view the high cost of labour, due to increases in rates of pay and the reduction of the working week to 40 hours, together with the fact that the whole of the horizontal retort plant was in a dilapidated state, the Board decided to install new carbonizing plant of a type which would give not only an increased make of gas per ton of coal carbonized as compared with the existing plant, but also a reduction in manufacturing costs from the decrease in the number of men which would be required to operate it. A further stipulation which was laid down was that the plant should be able to carbonize 100% New Zealand coals, the majority of which are very highly swelling.

The type of plant finally selected was one of intermittent vertical chambers. Tenders were duly invited and after careful investigation by the Board their order for the new plant was placed with Gas Chambers & Coke Ovens, Ltd., of Artillery House, Westminster, for a C.O.L. plant of 540,000 cu.ft. per day capacity.

Type of Coal Used

It was originally proposed that equal quantities of the following coals would be used: State Large, Point Elizabeth, Mount Burnett, and State Smalls. During the construction of the plant, however, investigation showed that Point Elizabeth and Mount Burnett coals, although high in volatiles, were not particularly desirable coals to carbonize, as Point Elizabeth was practically non-coking, and Mount Burnett averaged 14% ash or more. It was therefore decided not to employ these two coals, and, actually, State Smalls have been used almost exclusively. These are of the nature of an unwashed slack, the moisture content varying over a considerable range according to whether the coal was shipped and unloaded in fine or wet weather, and the swelling index as determined by the British Standard method No. 804 is 9 plus.

During carbonization the coal froths very considerably so that the resultant coke is not as strong structurally as the swelling figure and the after-shrinkage would lead one to expect.

The make per ton expected from the original mixture was 20,000 cu.ft. of 460 B.Th.U. gas, or 92 therms per ton. The weight per cubic foot of the mixture was given as 51 lb., but that of State Smalls was somewhat less than this since, with the given weight, the chambers were built to take a charge of 2.25 tons, while with State Smalls the average charge was some 2.15 tons.

The plant comprises eight chambers, set in three beds, two beds having three chambers and one bed two chambers. The chambers were constructed as to the top and bottom portions in high-grade alumina material, while the middle section—*i.e.*, the heating zone—was built of 95% silica.

The heating of the settings is by means of a system of superimposed combustion chambers, and by this means the conditions for successful carbonizing, as well as long life of the settings, can be obtained—*namely*, high average with low maximum temperature.

Special Heat-Resisting Metal

The bottom doors and their frames are made of meehanite, a special heat-resisting metal which has the valuable property of minimum growth under repeated heating and cooling, thereby ensuring long life together with gas-tightness of the doors. Tubes of solid drawn steel are cast into the frames, which not only act as a reinforcement but also serve for introducing steam to the chamber after carbonizing is completed. The tubes are straight through and are provided with a plug at each end so that any dust which may have accumulated can be easily brushed out.

There are two producers, external to the setting, each delivering gas into a bus main from which necks lead into the individual setting. The producers are amply proportioned and are provided with steam blowers for working under pressure should the nature of the fuel require this. Isolated dampers on the producer gas uptakes and also in the setting necks provide for the shutting down of either producer or any setting without interfering with the working of the other producer or the remaining settings.

The coke is discharged into a hot coke bus of massive construction, with renewable cast-iron liner plates, and is quenched under a tower by a regulatable quantity of water, thus ensuring that it is neither under nor over quenched. After quenching, the car is hauled up a gantry and discharged.

Top and Bottom Outlets

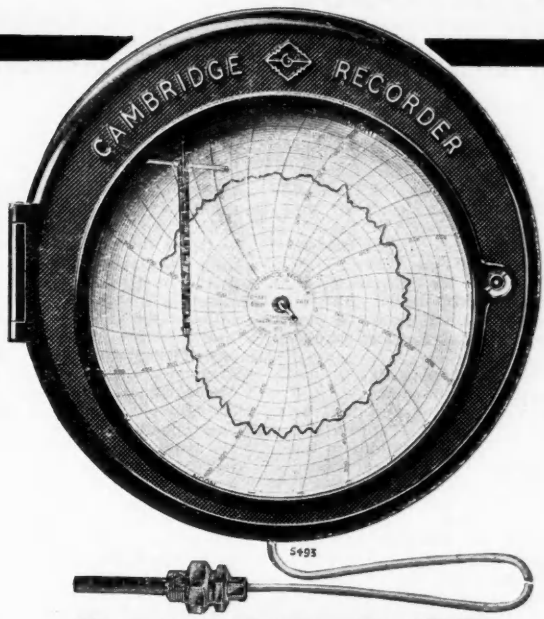
Each chamber is provided with both a top and bottom gas outlet, each of these being fitted with a positive type shut-off valve. The gas from both the top and bottom outlets is delivered into a common main, the pull in which is governed by means of an Arca regulator, thus ensuring constant pressure conditions in the chambers. The settings being non-recuperative, a waste heat boiler of the firetube type, built by Spencer-Bonecourt, is provided at top of setting level.

At the present time the storage capacity at Petone is only about 14 hours send-out and, with a varying load, it has not been found possible to run a special test, as the plant has to be worked to suit the send-out and holder stocks. However, the average make per ton for the three months ended March 31, 1939 (summer months in New Zealand) was 19,409 cu.ft. of 465 B.Th.U. gas, or 90.25 therms.

The ground on which the plant is built was originally part of the bed of the Hutt River, but good clay was met some 8 or 9 ft. down, so that piling was not necessary. Since, however, the plant is in an earthquake zone, a special type of foundation was necessary to comply with the local earthquake regulations and precautions were also taken in the design of the steelwork frame building so as to reduce the risks of damage in the event of an earthquake taking place.

The plant is giving every satisfaction, and as it is situated in a growing district the increased sales have necessitated an extension of the plant earlier than was originally contemplated, and, subject to the Loans Board's approval, this extension has been entrusted to the original contractors.

CAMBRIDGE THERMOGRAPHS



These robust instruments embody all the improvements made possible by modern research. Under ordinary care their accuracy may be depended upon not only when newly installed but over a long period of years. The charts are 10 inches in diameter, with clear and open graduations.

The capillary tubing is constructed by a patented method which enables continuous lengths up to 120 feet to be used without joints, links, or any form of temperature compensation. The bore is only 1/40th the diameter of the tubing, ensuring great robustness and long service.

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FOLDER 65-D

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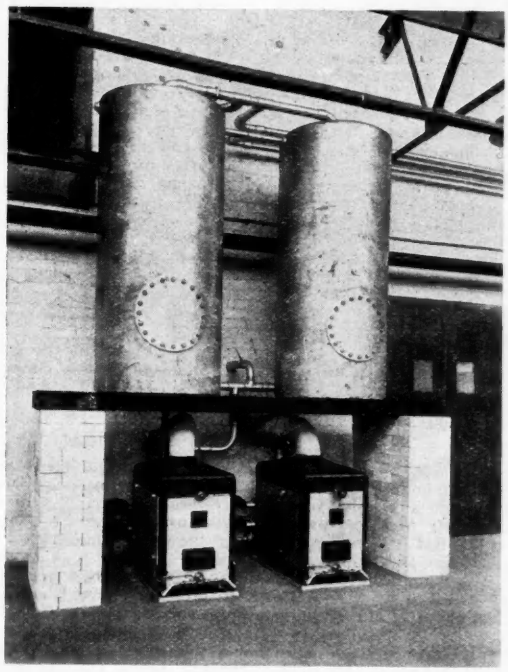
GAS HEATING FOR MILITARY CAMPS AND A.R.P. DUTIES.



Typical example of Potterton direct-heated gas-fired storage system for hot water supply and central heating at a large decontamination centre.

"REX" Gas-fired Hot Water Sets.
"REX" Gas-fired Central Heating.
Gas-fired Decontamination Tanks.

The latest practice in meeting the important demands in warming, cleansing and decontamination is embodied in The Potterton Specification of which detailed schemes will be submitted upon receipt of plans showing the buildings to be treated.

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The Maclaurin Case

Evidence at Resumed Hearing

THE hearing of the action in which Mr. Robert Maclaurin, inventor of the Maclaurin low-temperature carbonization process, sued Mr. J. W. McLusky (Engineer and General Manager of the Glasgow Corporation Gas Department) was resumed at Glasgow Sheriff Court on November 13. Pursuer claimed £10,000 damages as a result of defender's alleged attitude towards the process as installed at the Provan Gas-Works.

Questioned by MR. A. M. M. WILLIAMSON, for defender, as to whether the plant had failed as a commercial proposition, whatever the cause, *Pursuer* denied that this was so as the plant was not run as such. He agreed, however, that it was a financial failure in the hands of the Glasgow Corporation.

Mr. Thomas Johnston, who was in charge of stocks at the Corporation's Chemical Works, appeared for the defender, and denied that Mr. McLusky had ever suggested to him that he should make the results of the Maclaurin process appear "a little less rosy." He admitted an error of 100,000 gallons in the credit given for oil distilled by the plant in the year ended May 31, 1929, but explained that this was due to a clerical error in addition. The source of the error had not been discovered.

Dr. E. W. Smith (Technical Director of the Woodall-Duckham Companies) stated in evidence that he had had certain discussions and negotiations with Maclaurin Carbonization, Ltd., who were the then owners of the plant, but declared that his Company had no financial interest whatever in the process. The negotiations between his Company and the Maclaurin Company came to an end in June, 1922. In the course of these negotiations there was never at any time any suggestion made to Dr. Smith that the Woodall-Duckham Companies should consult with the Glasgow Corporation about the Maclaurin process; nor was the Woodall-Duckham Companies negotiating with the Corporation at that time for the supply of any gas plant. A contract with the Corporation had been started in 1919, before the defender came to Glasgow, and they were engaged in erecting plant at Glasgow during the period concerned. Dr. Smith said he met defender for the first time in January, 1922. The next contract from the Glasgow Corporation was for a vertical retort installation at the Dawsholm Works in 1927.

Dr. Smith observed that at the time when his Company were carrying on negotiations with the Maclaurin Company he had no idea that the Glasgow Corporation were in any way interested or likely to be interested in the process. He denied with the greatest emphasis that in any way, either from the defender or any of his assistants, or any member of the Corporation, was there any suggestion ever made by them or by the Woodall-Duckham Company that there should be any financial consideration in any connexion whatever, particularly in connexion with the Maclaurin process, because there was no discussion of that at the time or at any time, and it had not been suggested. From his side of the matter, it was never even hinted, or from the other side, from the defender's side, or by any of his assistants. At no time was it suggested that any financial consideration should be given to the defender, his assistants, or any person connected with the Glasgow Corporation with a view to their granting undue favour to a proposition put forward by the Woodall-Duckham Companies.

Mr. James McLeod (Manager of the Glasgow Gas Department's Chemical Works) stated that the Maclaurin plant had every consideration and assistance from everyone in his department.

Sympathetic Towards Experiment

When the hearing was resumed on Nov. 14, *Mr. McLusky* said that towards the end of 1921 it was remitted to him to carry out a test of the Maclaurin process as Grangemouth. They were sympathetic towards the experiment. Quite frankly, said Mr. McLusky, they admired Maclaurin's genius. He was a pioneer in smokeless fuel, but they regarded the process as a means of supplying smokeless fuel and never town gas. Examined by his Council he said that his attitude did not change in any way during 1921, nor had it ever changed. The Glasgow Corporation was interested in the smokeless fuel product of the process but had plenty of gas already. He denied emphatically that his attitude had changed because of some inducement held out to him by the Woodall-Duckham Company. There was no truth in the suggestion. He had no sentiments of hostility against pursuer or his plant. His reports were made on the instructions of the Corporation and in the course of his duty as Gas Manager. He was instructed to report on the working of the plant at Dalmarnock up to Dec. 31, 1925. He asked Mr. Frazer, who was in charge of the plant, to give him notes and these notes he embodied in his report to the Gas Committee. He made pencil alterations in Mr. Frazer's report, and his own report was simply that of Mr. Frazer, but edited. He denied that the report was drafted to create the impression that the Maclaurin process had failed to fulfil the claims made on its behalf. It indicated the experience of the working of the plant and struck a warning note that the Corporation was likely to sustain a heavy loss. He was anxious to make the process a success, as it would be to his credit. Until shortly before the action pursuer had never suggested to him that any of his statements or reports were inaccurate. He denied that in making up any report he had any intention of injuring Mr. Maclaurin or his process. To the best of his belief everything he wrote in his reports was true at the time he wrote them.

At the resumed hearing on Nov. 15 *Mr. McLusky* said that an enquiry had shown there was a large potential market in Glasgow for industrial gas. He had not passed on that information to his Committee, as potential users already had Glasgow gas available.

Sheriff GUILD said that cross-examination about certain figures was not relevant to the case. It was a question of veracity that was being tried.

Alterations to Plant

Questioned regarding alterations made by him in Mr. Frazer's notes on the Maclaurin plant, *Mr. McLusky* said he did not agree with Mr. Frazer's statement that on the whole everything was working satisfactorily. Everything considered, the plant was not working satisfactorily. He had said in his report that the proposed alterations would produce easier working. He was anxious to put the plant in good order and to produce smokeless fuel. He admitted that the fact that the Maclaurin plant produced 400 million cu.ft. of gas in 1925-26 had not been shown in the Smokeless Fuel Accounts for that period. The omission was seen by him when it was too late. It would have been absolute foolishness to pass the account and know this fact had been omitted. He had not given instructions that the Commercial Department should not be notified of this gas having been made.

In reply to Sheriff Guild, Mr. McLusky said that if this gas had been taken into account it would have reduced the loss on the plant from £12,000 to £8,000.

On Nov. 16 *Mr. McLusky's* cross-examination continued. He asserted that his reports to his Committee were absolutely fair. The plant was a complete failure as a commercial proposition. He denied that his statements and reports were misleading and false. He denied that he had ever had any hostility towards the Maclaurin plant. He denied that no precautions were taken to send out the smokeless fuel in a good and dry condition. He had given instructions that the plant was to get every chance, both commercially and technically. Re-examined by Mr. Williamson, he denied giving instructions that the smokeless fuel should not go out dry. His reports dealt with their experience of the plant, irrespective of whether it was a success or a failure. The Corporation had lost £53,000 on the plant, and even allowing for the failure to credit the plant with gas made there was an average loss over seven years of £7,000 annually, on a capital expenditure of £45,000. The amount of fuel sold as "Kincole" was an unsatisfactory percentage.

On Nov. 21 the Court was held in Burnside at the home of Mr. J. K. Frazer, retired Station Manager of the Dalmarnock Gas Works, who for medical reasons could not attend at the County Buildings in Glasgow.

Anxious for Fair Trial of Plant

Mr. Frazer, replying to MR. WILLIAMSON, said the Maclaurin plant was under his charge while it was at Dalmarnock. He had never seen any indication that Mr. McLusky was hostile to the plant. Mr. McLusky was more than anxious to give it a fair trial, and he had never suggested that the plant should be run in such a way as to show a loss.

Cross-examined by MR. COHEN, *Mr. Frazer* said that in 1926 he was asked by Mr. McLusky to provide him with a report of the working of the plant. In his report he had written that on the whole the plant was working fairly satisfactorily. The qualification he had made was that easier working was anticipated by the proposed alterations. He had found the gas produced by the Maclaurin plant quite up to expectations both in quality and in quantity. Asked what he meant by the word "indifferent"

relating to the quality of the smokeless fuel, witness said that he meant it was no good to be sold as smokeless fuel alone.

Test of Solid Fuel

Questioned by MR. COHEN (for the pursuer) on Nov. 22 regarding "Kincole," *Mr. Frazer* said he had seen the fuel tested in a grate at the gatehouse at Dalmarnock; that was what he called the housewife's test. He said it "crackled and sparked all over the place." It seemed to him there was a great deal more made of the moisture in "Kincole" than was justified. Witness explained that he was responsible for tuning up the Maclaurin plant for a test which was made in 1928 by the Fuel Research Board. There was something exceptional about the working conditions, as they were running a test on one unit only but were using the whole of the ancillary plant which was put down for 10 units.

Re-examined by MR. WILLIAMSON, witness said he made monthly reports in connexion with the plant to Mr. McLusky or to the head office of the Gas Department, and that from these reports anyone who had desired to calculate the cost per ton could do so.

Dr. R. Lessing (Consulting Chemist and Chemical Engineer) said he definitely did not think it would have been a reasonable thing to put the Maclaurin gas into the city supply for use in domestic burners. The size of the service pipes would have been affected, unless the existing pipes were over-capacity and would carry an extra load.

Dr. R. Lessing, cross-examined on Nov. 23 by Mr. COHEN, agreed that Mr. Maclaurin attributed the sparking in "Kincole" to moisture, but in his view the sparking could not possibly be due to water. It was possible to have a coal which, burned in a domestic grate in its raw state, would not give sparking, but when put through the Maclaurin plant would give sparking, because the condition for sparking was set up by the carbonization treatment. He had no practical experience of non-sparking coal going into the Maclaurin plant and sparking material coming out. Sparking could be got with certain raw coals.

Re-examined by Mr. WILLIAMSON, witness said that the same type of coal submitted to low-temperature carbonization and to high-temperature carbonization might give sparking in the low-temperature fuel and not in the high.

This concluded the evidence, and Sheriff D. A. GUILD adjourned the Court until January (the date to be afterwards fixed) for addresses by counsel.

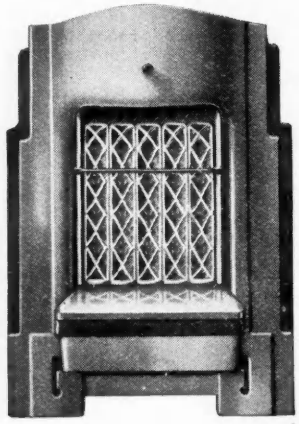
Deal and Walmer Gas Company

The Ordinary General Meeting of the Deal and Walmer Gas Company was held at Gas Industry House on Nov. 22.—Mr. HENRY WOODALL presiding in the absence of the Chairman, Sir David Milne-Watson. The Directors' report and statement of accounts for the year ended June 30, 1939, showed that the net revenue for the year, after providing for debenture interest and all other expenses, including the cost of the new capital issue, amounted to £4,350, to which should be added the balance brought forward from last year of £2,317, making a grand total of £6,667. Out of this sum had been paid dividends amounting to £3,469, made up of £897 dividends on the new issue of preference stock for the eleven months ended June 30, 1939, and £2,571 dividend on the ordinary stock in respect of the half year ended Dec. 31, 1938, at the rate of £6 17s. 6d.% per annum, less income tax. There remained, therefore, £3,197, out of which the Directors recommended the payment of a dividend on the ordinary stock in respect of the half-year ended June 30, 1939, at the rate of £6 5s.% per annum, less income tax. The payment of this dividend would absorb the sum of £2,337, leaving to be carried forward £859. In the course of his remarks Mr. Woodall observed that the sale of gas for the year showed a satisfactory increase of 1¼% compared with the previous year. During the cold weather in December all previous records for gas output were broken, and on Dec. 24 the output was 881,000 cu.ft., an increase of 15% on the former record day. This is good evidence of the progress which has been made in installing additional gas apparatus in the last few years. In the course of the year the Directors appointed Mr. S. L. Wright, former Manager of the Sittingbourne District Gas Company, to the position of Deputy Engineer and Manager of the Company. Mr. Tyndall, who had been Manager of the Company for nearly 18 years, had expressed a wish to retire at the end of this year. As this was the last general meeting which he would attend in the capacity of Manager the Chairman took the opportunity of expressing the appreciation of the Directors for his loyal and valuable service to the Company. The report and accounts were adopted and the dividend, as recommended, was declared. The retiring Directors, Sir David Milne-Watson and Mr. R. W. Foot, were re-elected.

Two Portable Aids to "Emergency" Gas Heating

The NEWSCREEN Fire

An efficient gas-fire of pressed-steel construction, lightweight, and easily carried from room to room and fixed to "plug-in" points. Its extreme lightness has been achieved without lessening its qualities as a thoroughly dependable gas-fire of strong build, fulfilling the requirements of the "Lancet" test. The No. 3205 size can be supplied with a lighter fitted at a convenient point near the top of the frame (see illustration).



Each NEWSCREEN has a loose panel which covers up and protects the radiants when the fire is not in use.

When the fire is in use the panel can be attached to the back of the frame.

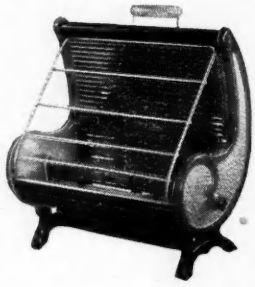
A carrying handle is provided at the back above the flue opening.

The NEWSCREEN can be had in a variety of attractive duotone colour finishes.

The GLOWMAIN Heater

A convenient and effective little "flueless" heater, with a very low gas consumption of about 12.5 cubic feet per hour.

Its cast-iron sides are covered internally by a separate chromium-plated lining which keeps the outside from becoming overheated. There is also a separate back with ventilating channels between the exterior back and the reflector.



Direct radiant heat cannot reach the floor. The cast-iron feet ensure rigidity.

A dress-guard is provided and this is sprung into position top and bottom, and can thus be easily removed to allow the reflector to be dusted. The burner and the heating element are also easily removed. A lighter is fitted at the side, as shown.

The GLOWMAIN is obtainable in a choice of colour finishes.

Stock these economical aids to "Emergency" Gas Heating

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Markets and Manufactures

Current Sales of Gas Products

The London Market

Nov. 27.

We give below a note of the present position in the London tar products market:

Pitch about 32s. 6d. per ton f.o.b.

Creosote about 5d. per gallon.

Refined tar 3¾d. to 4d.

Toluole is now controlled by the Ministry of Supply Order No. 1, which fixes the maximum price at which this material can be sold.

Pure benzole about 1s. 9d.

95/160 solvent naphtha about 1s. 10d.

90/160 pyridine 14s. to 14s. 6d.

All per gallon naked.

Refined naphthalene crystals about £16 per ton in bags.

All *ex* makers' works.

The Provinces

Nov. 27.

Crude Gas-Works Tar, 10s. to 15s.

To avoid misunderstanding, it is necessary to state that the above price is not claimed to represent a market value. It is a price worked out from week to week upon a system which has been used for many years as a basis for the fixing of certain contracts for crude tar of varying qualities in different areas.

The average prices of gas-works products during the week were: Pitch—East Coast, 25s. to 27s. f.o.b. West Coast—Manchester, Liverpool, Clyde, 25s. to 27s.* Toluole, naked, North, 1s. 10d. to 1s. 11d. Coal tar, crude naphtha, in bulk, North 7¾d. to 8¼d. Solvent naphtha, naked, North, 1s. 4½d. to 1s. 5d. Heavy naphtha, North, 1s. 2¼d. to 1s. 3d. Creosote, *ex* works, in bulk, North, liquid and salty, 3¾d. to 4¼d.; low gravity, 4d. to 4½d. Carbolic acid, 60's, 1s. 7d. to 1s. 10d. Naphthalene, £13 10s. to £16. Salts, 70s. to 75s., bags included. Anthracene, "A" quality, 4½d. to 4¾d. per minimum 40% purely nominal, "B" quality unsaleable. Heavy oil: Unfiltered anthracene oil, min. gr. 1,080, 4¾d. to 4¾d.; filtered anthracene oil, min. gr. 1,080, 5½d. to 5¾d.; heavy tar oil, gr. less than 1,080 4½d. to 4¾d.

* All prices for pitch are now quoted on the basis of f.o.b. In order to arrive at the f.a.s. value at any port it will be necessary to deduct the loading costs and the tolls, whatever they may be.

Scotland

GLASGOW, Nov. 25.

Business during the week has been comparatively quiet but prices of most products continue firm.

Crude gas-works tar.—Actual value is round 30s. to 32s. per ton *ex* works in bulk.

Pitch of vertical quality is difficult to move with value at 23s. to 24s. per ton, f.o.b. for export, and round 20s. to 22s. 6d. per ton *ex* works in bulk for home trade.

Refined tar is exceptionally quiet with controlled price in the home market unchanged at 3¾d. to 4d. per gallon. For export, supplies are readily obtainable at 2¾d. to 3d. per gallon, filled into buyers' packages at makers' works.

Creosote oil.—Substantial business is pending for the railway companies and prices are firm as follows: Specification oil, 4¾d. to 5d. per gallon; low gravity, 5¼d. to 5¾d.; neutral oil, 5¼d. to 5½d. per gallon; all *ex* works in bulk.

Cresylic acid.—A fair volume of prompt business continues to be placed and many makers are already fairly well sold forward on contract. Prices are as under: Pale, 97/99%, 2s. 2d. to 2s. 4d. per gallon; dark, 97/99%, 1s. 10d. to 2s. per gallon; pale, 99/100%, 2s. 6d. to 2s. 9d. per gallon; all *ex* works in buyers' packages.

Crude naphtha continues to be valued at 6d. to 6½d. per gallon *ex* works in bulk, according to quality.

Solvent naphtha.—90/160 grade is 1s. 7½d. to 1s. 8½d. per gallon and 90/190 heavy naphtha is 1s. 3½d. to 1s. 4½d. per gallon.

Motor benzole remains at 1s. 6d. to 1s. 7d. per gallon.

Pyridine.—Values are nominal at 12s. to 13s. per gallon for 90/160 grade and 14s. to 15s. per gallon for 90/140 grade.

Contracts Advertised

Coal.
Keighley Gas Department. [p. 470.]

Station Meter Drum.
Skipton Gas Department. [p. 470.]

Dividend Announced

Malta and Mediterranean.—The Directors of the Malta and Mediterranean Gas Company announce that the Company's interim dividend, which is payable on Dec. 16, will be at the rate of 4% per annum, free of income tax. This corresponds with a rate of 5%, tax free, last year.

Peterborough Stock Issue

The whole of the consolidated ordinary stock of the Peterborough Gas Company which was recently offered for auction, as previously announced in these columns, was disposed of. The total amount offered was £17,025 6s. 11d., including premiums, and the average price realized was between £145 and £147 per £100 of stock. The first lot offered attained the maximum price of £150.

War-Time Changes of Address

At the outbreak of hostilities Messrs. Turner Asbestos Cement Co. (branch of Turner & Newall, Ltd.), announced that they had moved their London Office to temporary quarters at Broxbourne, Herts. A more permanent arrangement has since been made, and their London Office is now—Sales Office, Erith, Kent. 'Phone: Erith 3020-3. Telegrams: "Asbestos," Erith. The firm apologize for the inaccessibility of their London staff since the outbreak of war, and keenly regret the confusion and inconvenience this must have caused. Unfortunately, the telephone facilities at the premises temporarily occupied were inadequate, and the Post Office, in the present emergency, were unable to remedy the deficiency.

Underpressure Engineering Co., Ltd., 14, Mill Road, Burgess Hill, Surrey. 'Phone: Burgess Hill, 2023.

A.R.P.
PROTECTION OF SANDBAGS.

METRO CREOSOTE EMULSION

METRO COPPER CREOSOTE EMULSION

Both Emulsions conform to the Specification of the Ministry of Home Security Memorandum A.R.P. 279/1939 — 20/10/39, and are available in GREEN at slight additional cost.

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REGIS HOUSE,
KING WILLIAM STREET,
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At the present stage of the national emergency we are in a position to form some idea of the conditions under which engineering production for the Gas Industry will have to be carried on in the immediate future

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COAL AND COKE PLANTS

With a number of Contracts in progress and with many orders on our books for resetting and maintenance parts, we find we are able to carry on with existing Contracts, and to meet all requirements for the normal repairs and maintenance of existing installations

We trust that our clients will not hesitate to send us their enquiries for new plant, renewals or spare parts, relying upon us to do our very best, under whatever conditions may exist from time to time, to fulfil as heretofore our obligations to the Gas Industry

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WEST'S CARBONIZING PLANTS

GAS STOCKS AND SHARES

Quieter conditions prevailed in most departments of the Stock Exchange during the early part of last week and prices were inclined to fluctuate, although towards the close more interest was discernible. The chief feature was a heavy demand for home-rail stocks on the Minister of Transport's statement on the subject of Government compensation and some sharp gains in prices ensued. Several bright features were reported in the miscellaneous market, especially among iron, steel, and textile shares. Mining shares showed signs of recovery, but oils and rubbers closed quiet and dull.

The Gas market attracted a little more attention and a number of issues improved on the week. Brighton 6% recovered 5 points of the previous week's loss, Bombay closed another 6d. higher, and several Gas Light fixed-interest stocks again hardened. On the other hand, South Suburban reacted 4½ to 80½, and Northampton has been brought more into line with current values with a drop of 13 to 90½. In the Supplementary List, it is interesting to note that Peterborough ordinary, which was marked down 31½ points the previous week, has recovered 30, and the nominal quotation of Ryde ordinary closed 10 points higher at 115. Prices at the Provincial Exchanges remained unchanged.

The accounts of the Oriental Gas Company for the year to June 30 last show that, whilst the gross receipts show a small increase over the previous year, the gross profit is £12,127 less owing mainly to extra expenditure on wear and tear of plant, heavier distribution costs, and higher charges for rent, rates, and taxes. After allowing for interest credits and profit on exchange and providing for the interim dividend payment and £3,103 for writing down investments, there remains a balance of £144,957 available for dividend. The Directors have distributed an interim dividend of 3½%, free of income tax, and now recommend a final dividend of 4½%, which, as foreshadowed by the Chairman in his speech at last year's annual meeting, is to be paid less income tax. This will leave a balance forward of £131,457, against £128,020 last year.

Official Quotations on the London Stock Exchange

Issue. £	When ex-Dividend.	Dividends. Prev. Hf. Yr. % p.a.	Dividends. Last Hf. Yr. % p.a.	NAME.	Quotations Nov. 24.	Rise or Fall on Week.
1,767,439	Sept. 4	8	8	Alliance & Dublin Ord. ...	110—120	...
374,000	June 19	4	4	Do. 4 p.c. Deb. ...	80—90	...
877,576	Nov. 6	5	5	Asscd. Gas & Water U'd'ts Ord.	14/6—16/6	...
500,000	,,	4½	4½	Do. 4½ p.c. Red. Cum. Pref.	17/6—19/6	...
535,545	,,	4	4	Do. 4 p.c. Red. Cum. Pref.	16/—18/—	...
318,730	,,	4	4	Do. 4 p.c. Irred. Cum. Pref.	15/—17/—	...
750,000	Sept. 18	3½	3½	Do. 3½ p.c. Red. Deb. ...	80—85	...
560,070	Aug. 21	7	7	Barnet Ord. 7 p.c.	110—120	...
300,000	Oct. 9	1/9⅔	1/4⅔	Bombay, Ltd.	19/6—20/6	+—/6
181,185	Aug. 21	9½	9½	Bournemouth Sliding Scale ...	135—145	...
690,526	,,	7	7	Do. 7 p.c. max. ...	110—130	...
493,960	,,	6	6	Do. 6 p.c. Pref. ...	110—120	...
50,000	June 5	3	3	Do. 3 p.c. Deb. ...	70—75	...
362,025	,,	4	4	Do. 4 p.c. Deb. ...	93—98	...
335,000	,,	5	5	Do. 5 p.c. Deb. ...	105—110	...
357,900	Aug. 21	7½	7½	Brighton, &c., 6 p.c. Con. ...	105—110	+5
659,955	,,	6½	6½	Do. 5 p.c. Con. ...	100—105	...
205,500	,,	6	6	Do. 6 p.c. 'B' Pref. ...	95—105	...
855,000	Sept. 18	8	7	British Ord.	90—100	...
100,000	June 19	7	7	Do. 7 p.c. Pref.	136—141	...
350,000	,,	5½	5½	Do. 5½ p.c. 'B' Cum. Pref.	110—115	...
120,000	June 5	4	4	Do. 4 p.c. Red. Deb. ...	75—80	−17
450,000	,,	5	5	Do. 5 p.c. Red. Deb. ...	100—105	...
100,000	22 May '33	6	4	Cape Town, Ltd.	¼—¾	...
100,000	6 Nov. '33	4½	4½	Do. 4½ p.c. Pref.	¼—¾	...
150,000	June 19	4½	4½	Do. 4½ p.c. Deb.	58—68	...
626,860	July 17	6	6	Cardiff Con. Ord.	95—105	...
237,860	June 5	5	5	Do. 5 p.c. Red. Deb. ...	97—102	...
98,936	Oct. 9	2/—	2/—	Colombo Ord.	1 7/16—1 9/16	...
24,510	,,	1/4⅜	1/4⅜	Do. 7 p.c. Pref.	20/6—22/6	...
739,453	Sept. 27	−/11.48	−/11.48	Colonial Gas Assn. Ltd. Ord. ...	15/—17/—	...
296,144	,,	1/3.30	1/3.30	Do. 8 p.c. Pref.	20/6—22/6	...
1,775,005	July 31	4	4	Commercial Ord.	48—58	...
140,000	Aug. 21	4	4	Do. 4 p.c. Red. Pref. ...	88—93	...
620,000	June 5	3	3	Do. 3 p.c. Deb.	55—60	...
286,344	Aug. 21	5	5	Do. 5 p.c. Deb.	85—95	...
200,000	,,	3¾	3¾	Do. 3¾ p.c. Red. Deb. ...	94— 99	...
807,560	July 31	7	7	Croydon sliding scale	100—110	...
644,590	,,	5	5	Do. max. div.	80—85	...
620,385	June 19	5	5	Do. 5 p.c. Deb.	90—100	...
208,660	Aug. 21	5	5	Dudley, Brierley Hill & Dist. Ord.	100—105	...
82,275	,,	5	5	Do. 5 p.c. Con. Pref. ...	92—102	...
79,000	,,	3¾	3¾	Do. 3¾ p.c. Red. Deb. ...	94—99	...
239,000	July 31	5	5	East Hull Ord. 5 p.c.	86—91	...
187,215	Aug. 21	6	5¾	East Surrey Ord. 5 p.c. ...	98—103	...
176,211	June 5	5	5	Do. 5 p.c. Deb. ...	90—100	...
250,000	Nov. 13	8	4	Gas Consolidation Ord. 'B' ...	17/—19/—	...
250,000	,,	4	4	Do. 4 p.c. Red. Cum. Pref.	16/—18/—	...
9,172,463	July 31	5¾	5¾	Gas Light & Coke Ord. ...	16/—17/—a	...
2,600,000	,,	3½	3½	Do. 3½ p.c. max.	58—63	...
4,477,106	,,	4	4	Do. 4 p.c. Con. Pref. ...	76—81	...
2,993,000	July 3	3¾	3¾	Do. 3¾ p.c. Red. Pref. ...	80—85	...
8,602,497	May 22	3	3	Do. 3 p.c. Con. Deb. ...	67—72	+5
3,642,770	,,	5	5	Do. 5 p.c. Red. Deb. ...	100—105	+3
3,500,000	,,	4½	4½	Do. 4½ p.c. Red. Deb. ...	97—102	+1
700,000	Sept. 4	3½	3½	Do. 3½ p.c. Red. Ded. ...	85—90	...
270,466	July 31	6	6	Harrogate New Cons.	95—100	...
157,500	Mar. 20	‡1/—	‡1/—	Hong Kong and China Ord. ...	⅛—¾	...
5,600,000	Oct. 23	12	4	Imperial Continental Cap. ...	76—81	−1½
172,810	July 31	3½	3½	Do. 3½ p.c. Red. Deb. ...	85—90	−2½
63,480	June 19	3	3	Maidstone 3 p.c. Deb.	57—62	...
45,000	May 22	†10	†10	Malta & Mediterranean ...	95—105	...
				Metropolitan (of Melbourne) ...		
392,000	Oct. 2	5½	5½	5½ p.c. Red. Deb.	95—100	...
231,977	Aug. 21	5	5	M.S. Utility 'C' Cons.	70—80	...
968,658	,,	4	4	Do. 4 p.c. Cons. Pref. ...	70—80	...
390,076	June 19	4	4	Do. 4 p.c. Deb. ...	75—85	+5
1,487,439	June 19	5	5	M.S. Utility 5 p.c. Deb. ...	90—100	...
374,000	,,	3½	3½	Do. 3½ p.c. Red. Bds. ...	92—95	...
877,576	July 3	3½	3½	Montevideo, Ltd.	50—60	...
500,000	Aug. 21	7½	7½	North Middlesex 6 p.c. Con. ...	105—115	...
535,545	July 31	5	5	Northampton 5 p.c. max. ...	88—93	−13
318,730	Nov. 6	†7	9	Oriental, Ltd.	118—128	...
750,000	June 5	7	8	Plymouth & Stonehouse 5 p.c.	100—110	−2
560,070	July 31	8½	8½	Portsmouth & Gosport Cons.	110—120	...
300,000	,,	5	5	Do. 5 p.c. max.	78—83	...
181,185	,,	5	5	Do. 5 p.c. Pref.	80—90	...
690,526	,,	4	4	Do. 4 p.c. Pref.	70—80	...
493,960	July 31	5	5	Preston 5 p.c. Pref.	90—100	...
50,000	June 19	4	4	Primitiva 4 p.c. Cons. Deb. ...	95—100	...
362,025	July 17	4	4	Do. 4 p.c. Red. Deb. ...	93—98	...
335,000	Sept. 4	6	6	San Paulo 6 p.c. Cum. Pref. ...	7¼—8½	...
357,900	Oct. 9	1/1½	1/1½	Severn Val. Gas Cor. Ld. Ord.	16/——19/—	...
659,955	Oct. 2	−/10⅝	−/10⅝	,, ,, 4½ p.c. Cum. Pref. ...	17/——19/—	+—/6
205,500	Aug. 21	5	8½	Shrewsbury 5 p.c. Ord. ...	107—117	...
855,000	June 5	†4	†4	South African Ord.	4—5	...
100,000	Aug. 21	1/2⅜	1/2⅜	South East'n Gas Cn. Ld. Ord.	15/6—17/6	...
350,000	,,	−/10⅝	−/10⅝	Do. 4½ p.c. Red. Cum. Pref.	17/——19/—	...
120,000	,,	4	4	Do. 4 p.c. Cum. Pref. ...	14/6—16/6	...
450,000	,,	4	4	Do. 4 p.c. Deb.	95—100	...
100,000	,,	3½	3½	Do. 3½ p.c. Red. Deb. ...	90—95	...
100,000	,,	6	5	South Met. Ord.	63—68	...
150,000	,,	6	6	Do. 6 p.c. Irred. Pref. ...	95—100	...
626,860	,,	4	4	Do. 4 p.c. Irred. Pref. ...	70—80	...
237,860	,,	3	3	Do. 3 p.c. Deb.	60—65	...
98,936	,,	5	5	Do. 5 p.c. Red. Deb. ...	97—102	...
24,510	,,	3⅜	3⅜	Do. 3⅜ p.c. Red. Deb. ...	92—97	...
739,453	July 31	6	6	South Suburban Ord. 5 p.c. ...	78—83	−4½
296,144	,,	5	5	Do. 5 p.c. Pref.	87—97	...
1,775,005	,,	4	4	Do. 4 p.c. Pref.	70—80	...
140,000	,,	3⅜	3⅜	Do. 3⅜ p.c. Red. Pref. ...	85—90	...
620,000	June 5	5	5	Do. 5 p.c. Deb.	90—100	...
286,344	,,	4	4	Do. 4 p.c. Deb.	75—85	...
200,000	,,	3	3½	Do. 3½ p.c. Red. Deb. ...	85—90	...
807,560	Sept. 18	1/2⅜	9⅔	S. Western Gas & Water Ord.	14/——16/—	...
644,590	Oct. 9	−/10⅝	−/10⅝	Do. 4½ p.c. Red. Cum. Pref.	17/6—19/6	...
620,385	June 5	4	4	Do. 4 p.c. Red. Deb. ...	92—97	...
208,660	July 31	5½	5	Southampton Ord. 5 p.c. ...	75—85	...
82,275	June 5	4	4	Do. 4 p.c. Deb. ...	75—85	...
79,000	July 31	5½	5½	Swansea 5½ p.c. Red. Pref. ...	90—100	...
239,000	June 19	3½	3½	Do. 3½ p.c. Red. Deb. ...	90—100	...
187,215	July 31	6½	6½	Tottenham and District Ord....	85—95	...
176,211	,,	5½	5½	Do. 5½ p.c. Pref.	95—105	...
250,000	,,	5	5	Do. 5 p.c. Pref.	85—95	...
250,000	June 19	4	4	Do. 4 p.c. Deb.	75—85	...
9,172,463	Oct. 23	6	4	U. Kingdom Gas Cor. Ord. ...	13/——16/—	...
2,600,000	,,	4½	4½	Do. 4½ p.c. 1st Cum. Pref. ...	14/——16/—*	−—/6
4,477,106	,,	4	4	Do. 4 p.c. 1st Red. Cum. Pf.	14/6—16/6*	−1/—
2,993,000	July 31	3½	3½	Do. 4½ p.c. 2nd Non-Cum. Pf.	12/6—14/6	−1/—
8,602,497	,,	3½	3½	Do. 3½ p.c. Red. Deb. ...	85—95	...
3,642,770	June 6	7	7	Uxbridge, &c., 5 p.c.	90—100	...
3,500,000	,,	5	5	Do. 5 p.c. Pref. ...	95—105	...
700,000	July 31	7	6½	Wandsworth Consolidated ...	85—95	...
270,466	,,	4	4	Do. 4 p.c. Pref.	70—80	...
157,500	June 19	5	5	Do. 5 p.c. Deb.	90—100	...
5,600,000	,,	4	4	Do. 4 p.c. Deb.	75—85	...
172,810	,,	3⅜	3⅜	Do. 3⅜ p.c. Red. Deb. ...	92—97	...
63,480	July 31	6¼	6¼	Watford and St. Albans Ord. ...	90—100	...
45,000	,,	5	5	Do. 5 p.c. Pref.	80—90	...
	,,	5½	5½	Do. 5½ p.c. Pref.	90—100	...
	,,	4	4	Do. 4 p.c. Rd. Pf. (1973/8)	85—90	...
	—	—	—	Do. 4 p.c. Red. Pf. (1959)	95—100	...
	June 19	4	4	Do. 4 p.c. Red. Deb. ...	95—100	...
	,,	3½	3½	Do. 3½ p.c. Red. Deb. ...	83—88	...

a.—The quotation is per £1 of Stock. * Ex. Div. † Paid free of income-tax. ‡ For year. § Actual.

Supplementary List and Provincial Exchanges overleaf.

STOCK AND SHARE LIST—Contd.

Supplementary List, not Officially Quoted, London

Issue. £	When ex-Dividend.	Dividends. Prev. Hf. Yr. % p.a.	Dividends. Last Hf. Yr. % p.a.	NAME.	Nominal Quotations Nov. 24.	Rise or Fall on Week.
202,152	Sept. 4	5	5	Ascot Ord.	80—90	...
128,182	July 3	5	5	Do. 5 p.c. Pref.	90—95	...
31,035	Aug. 21	-/4½	-/4½	Associated Utilities 4 p.c. Pref.	15/—17/-	...
100,000	June 19	3½	3½	Do. 3½ p.c. Red. Deb. ...	90—95	...
17,000	Aug. 21	8	8	Bognor Orig. Ord. 'A' ...	105—115	...
62,210	,,	8	8	Do. New Add. 'A' ...	105—115	...
87,160	,,	7	7	Do. New 7 p.c. max. ...	100—110	...
37,440	July 31	10	10	Cam. Univ. & Town 10 p.c. max.	110—120	...
125,970	,,	7	7	Do. 7 p.c. max.	90—100	...
39,025	,,	5	5	Do. 5 p.c. max.	80—90	...
96,410	July 17	4½	4½	Cardiff 4½ p.c. Pref.	92—97	...
55,520	July 31	6	6	Colchester 6 p.c. Pref.	100—110	...
90,550	Sept. 18	5	5	Do. 5 p.c. Deb. ...	100—105	...
150,000	July 31	4	4	Croydon 4 p.c. Pref.	70—75	...
130,000	June 19	4	4	Do. 4 p.c. Deb.	75—80	...
65,000	Aug. 21	7½	7½	Eastbourne 'A' 5 p.c.	105—115	...
198,000	,,	6	6	Do. 'B' 3½ p.c.	90—100	...
112,312	,,	5	5	Do. 5 p.c. Pref.	90—95	...
130,000	June 19	5	5	Do. 5 p.c. Deb.	95—105	...
130,500	Aug. 10	7½	7½	Exeter New Ord. (£10) ...	10—12	...
24,000	Aug. 21	8½	8½	Gt. Yarmouth 8½ p.c. max. (£30)	20—25	...
59,400	,,	7½	7½	Do. 7½ p.c. max. (£30) ...	17—22	...
51,160	June 5	5½	5½	Do. 5½ p.c. Deb.	100—110	...
152,600	Sept. 4	9	8	Guildford Cons.	110—120	...
54,055	,,	5	5	Do. 5 p.c. Pref.	90—95	...
68,250	June 5	5	5	Do. 5 p.c. Deb.	97—102	...
156,600	Aug. 21	7	7	Hampton Court Cons. ...	100—110	..
86,046	June 19	‡4½	‡5	Holyh'd&N.W.G.&W.Cpn.Ord.	13/6—15/6	...
80,000	Aug. 21	4	4	Lea Bridge 4 p.c. Pref.	65—75	...
60,000	,,	6	6	Do. 6 p.c. Pref.	105—115	...
94,876	June 5	4	4	Do. 4 p.c. Deb.	75—80	...
73,620	Sept. 18	8¾	8¾	Luton Cons. 'A'	105—115	...
107,960	Sept. 18	5½	4	Mid Kent Ord. (£10)	8—9	...
230,940	July 31	10	10	Oxford & District Ord. ...	130—140	...
47,112	,,	5	5	Do. 5 p.c. Pref.	85—95	...
50,000	,,	6	6	Do. 6 p.c. Red. Pref. ...	100—105	...
126,193	Oct. 30	7½	7½	Peterborough Ord.	130—140	+30
64,990	Sept. 18	7½	7	Redditch Ord.	100—110	...
166,850	July 31	8	8	Romford Ord.	110—120	...
60,000	,,	4	4	Do. 4 p.c. Pref.	85—90	...
44,000	Sept. 18	5	5	Do. 5 p.c. Deb.	95—100	...
25,570	July 31	5¼	5½	Rugby 5½ p.c. Pref.	95—105	...
25,000	,,	6	6	Do. 6 p.c. Red. Pref. ...	100—105	...
42,750	June 5	5½	5½	Do. 5½ p.c. Deb.	105—110	...
110,950	Aug. 21	8	8	Ryde Ord.	110—120	+10
270,086	Sept. 4	7	7	Slough Ord.	100—110	...
21,000	June 5	5	5	Do. 5 p.c. Deb.	95—100	.
28,872	Nov. 6	5½	5½	S. Midland Gas Cpn. Ltd. Ord.	14/—16/-	...
28,866	Sept. 18	4½	4½	Do. 4½ p.c. Red. Cum. Pref.	14/—16/-	...
117,228	Aug. 21	7	5	Swindon Cons.	70—80	...
60,425	June 5	5	5	Do. 5 p.c. Deb.	95—100	...
64,380	June 19	5	5	Torquay & Paignton 5 p.c. Pref.	85—90	...
130,000	Aug. 21	8	5	Wakefield Ord.	85—95	...
81,650	,,	5	5	Do. 5 p.c. max.	75—80	...
82,000	July 31	6	6	Weymouth Ord.	80—90	..
273,626	Aug. 21	7	7	Wolverhampton Cons. Ord. ...	95—105	...
98,384	,,	6	6	Do. 6 p.c. Pref.	105—115	...
160,000	June 19	5½	5½	Do. 5½ p.c. Red. Deb. ...	100—105	...
106,490	Aug. 21	5½	5½	Wrexham Ord.	70—80	...
90,000	June 19	5	5	York 5 p.c. Red. Deb.	97—102	...
133,640	July 31	6½	6	Yorktown (Cam.) 5 p.c. Cons.	80—90	...
120,000	,,	5	5	Do. 5 p.c. Pref.	85—95	...
35,000	June 19	5½	5½	Do. 5½ p.c. Deb.	105—110	...

BRISTOL EXCHANGE

Issue. £	When ex-Dividend.	Dividends. Prev. Hf. Yr. % p.a.	Dividends. Last Hf. Yr. % p.a.	NAME.	Quotations Nov. 24.	Rise or Fall on Week
347,756	July 31	6	5	Bath Cons.	107—112	...
1,667,250	,,	5	5	Bristol, 5 p.c. max.	97—100	..
120,420	June 5	4	4	Do. 1st 4 p.c. Deb. ...	89—93	...
415,250	,,	4	4	Do. 2nd 4 p.c. Deb. ...	89—93	...
328,790	,,	5	5	Do. 5 p.c. Deb.	110—113	...
274,000	July 31	5	5	Newport (Mon.) 5 p.c. max. ...	90—95	...
13,200	Sept. 4	8½	7	Pontyp'l Gas & W. 10 p.c. 'A'	12—13	...
13,600	,,	6	5	Do. 7 p.c. 'B'	10½—11	...
40,000	,,	6	5	Do. 7 p.c. 'C'	10½—11	...
140,778	July 31	5	5	Weston-super-Mare Cons. ...	93—98	...
64,338	June 19	4	4	Do. 4 p.c. Deb.	90—95	...
33,340	,,	7½	7½	Do. 7½ p.c. Deb.	140—150	...

LIVERPOOL EXCHANGE

Issue. £	When ex-Dividend.	Dividends. Prev. Hf. Yr. % p.a.	Dividends. Last Hf. Yr. % p.a.	NAME.	Quotations Nov. 24.	Rise or Fall on Week
157,150	July 31	6½	5	Chester 5 p.c. Ord.	100—103	...
92,500	June 5	4	4	Do. 4 p.c. Pref. ...	75—85	...
36,430	,,	3½	3½	Do. 3½ p.c. Deb.	86—89	...
41,890	,,	4	4	Do. 4 p.c. Red. Deb. ...	96—100	...
2,167,410	Aug. 21	6	6	Liverpool 5 p.c. Ord.	99—101	...
245,500	June 19	5	5	Do. 5 p.c. Red Pref. ...	90—95	...
306,083	July 17	4	4	Do. 4 p.c. Deb.	99—101	...
106,280	July 31	10	10	Preston 'A' 10 p.c.	174—184	...
188,219	,,	7	7	Do. 'B' 7 p.c.	126—136	...

NEWCASTLE EXCHANGE

Issue. £	When ex-Dividend.	Dividends. Prev. Hf. Yr. % p.a.	Dividends. Last Hf. Yr. % p.a.	NAME.	Quotations Nov. 24.	Rise or Fall on Week
122,577	Aug. 21	8	8	Blyth 5 p.c. Ord.	146½—148½	...
732,000	Aug. 21	3	4	Hartlepool G. & W. Cn. & New	74½—76½	...
2,061,315	July 31	5¾	5	Newcastle & Gateshead Con.	17/9—18/3a	...
682,856	,,	4	4	Do. 4 p.c. Pref.	75—85	...
776,706	June 5	3½	3½	Do. 3½ p.c. Deb.	84—89	...
277,285	April 24	5	5	Do. 5 p.c. Deb. '43 ...	100—105	...
332,351	Aug. 21	6	6	Sunderland 6 p.c. max. ...	110—120	...

NOTTINGHAM EXCHANGE

Issue. £	When ex-Dividend.	Dividends. Prev. Hf. Yr. % p.a.	Dividends. Last Hf. Yr. % p.a.	NAME.	Quotations Nov. 24.	Rise or Fall on Week
542,270	Aug. 10	9	6	Derby Con.	105—115	...
55,000	June 19	4	4	Do. 4 p.c. Deb.	100—105	...
20,000	June 19	5	5	Long Eaton 5 p.c. Pref. ...	9—11	...
80,000	,,	5	5	Do. 5 p.c. Deb. ...	100—105	...

SHEFFIELD EXCHANGE

Issue. £	When ex-Dividend.	Dividends. Prev. Hf. Yr. % p.a.	Dividends. Last Hf. Yr. % p.a.	NAME.	Quotations Nov. 24.	Rise or Fall on Week
10,000	Aug. 21	10	10	Great Grimsby 'A' Ord. ...	180—190	...
6,500	,,	10	10	Do. 'B' Ord. ...	160—190	...
79,000	,,	10	10	Do. 'C' Ord. ...	175—185	...
1,806,339	Feb. 20	6½	6½	Sheffield Cons.	120—123	...
95,000	July 3	4	4	Do. 4 p.c. Deb.	99—101	...

a The quotation is per £1 of Stock.
* Ex. div. ‡ For year.

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